GEC Project No. 1785-6080

APPLICATION FOR RISK-BASED CLEAN-UP OF POLYCHLORINATED BIPHENYLS (PCBs)

COURTYARD BEHIND 169.2 BRIDGE STREET
LOWELL, MASSACHUSETTS
MASSDEP RTN 3-33474
EPA IDENTIFICATION NO. (application was sent to MassDEP for permanent EPA ID #; awaiting feedback)

December 8, 2016

Prepared For:
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169.2 BRIDGE STREET
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APPENDICES

1.0 INTRODUCTION

Goldman Environmental Consultants, Inc., (GEC) of Braintree, Massachusetts was retained by R-M Developer, LLC to conduct response actions at 169.2 Bridge Street, Lowell, Massachusetts. GEC, on behalf of Massachusetts Mill III Limited Partnership (owner), has prepared the following Application for Risk-Based Cleanup of PCBs (hereinafter referred to as EPA Risk-Based Application) for the courtyard located behind 169.2 Bridge Street in Lowell, Massachusetts. This EPA Application is being submitted in support of a request for Coordinated Approval, pursuant to 40 CFR 761.77. Soils contaminated with polychlorinated biphenyls (PCBs) are also contaminated with metals and other oils or hazardous materials (OHM). The PCB and metal contamination was identified as a 120-day reportable condition under the Massachusetts Contingency Plan (MCP) [310 CMR 40.0000], and was assigned release tracking number (RTN) 3-33474 by the Massachusetts Department of Environmental Protection (MassDEP). Refer to Figure 1 for the Site Locus.

The MassDEP has assigned three other release tracking numbers to the Site: (1) RTN 3-33101 (presence of free-phase liquid in the subsurface of the courtyard); (2) RTN 3-33793 (oily sheen in the Concord River, which is associated with the free-phase liquid in the subsurface); and (3) RTN 3-33853 (asbestos in soils commingled with the PCB and metal contamination).

This EPA Risk-Based Application is intended to be conducted concurrent with and integral to both: (1) the Immediate Response Action (IRA) Plan Modification for RTN 3-33101 and the IRA Plans for 3-33793 and 3-33853, which were submitted as a single document on November 2, 2016 and conditionally approved by the MassDEP on November 22, 2016; and (2) the Release Abatement Measure (RAM) for RTN 3-33474, which was submitted to MassDEP on December 1, 2016 and conditionally approved by the MassDEP on December 7, 2016. Remedial actions for the EPA Risk-Based Application are the same as those identified in the RAM Plan for RTN 3-33474. This EPA Risk-Based Application provides the same information as in the RAM Plan for RTN 3-33474, but is expanded to also include that information required for the EPA Risk-Based Application.

Remedial actions of the RAM Plan of RTN 3-33474 will be conducted concurrent with the response actions of the IRA Plan Modification for RTN 3-33101 and RTN 3-33853. IRA remedial actions for RTN 3-33793 (petroleum sheen in the Concord River) are unrelated to the RAM remedial actions for RTN 3-33474, and are not discussed herein.

The proposed IRA for RTNs 3-33101, 3-33793 and 3-33853 was conditionally approved on November 22, 2016. One of the Site-specific conditions of approval required the submittal of a RAM Plan for RTN 3-33474 to provide a proposal for remediation of the PCBs and heavy metals. The IRA Plan Modification provided specific details on the remediation of the PCBs and heavy metals; therefore, the RAM Plan is a slightly modified version of the conditionally-approved IRA Plan Modification.

This EPA Risk-Based Application is prepared in accordance with 40 CFR 761.61(c), and is consistent with the RAM Plan for RTN 3-33474 and IRA Plan Modification for RTN 3-33101 / IRA Plan for RTN 3-33893.

2.0 SITE BACKGROUND AND HISTORY

2.1 Site History

The disposal site history was constructed based on interviews with property representatives; The EDR Radius Report (Appendix B); Sanborn Atlases and City Directories (e.g., Polk) provided by EDR (Appendix C); aerial photographs obtained from EDR (Appendix C); Middlesex North District Registry of Deeds records for the property obtained on-line from www.masslandrecords.com/middlesexnorth/ (Appendix D); historical topographic maps maintained online by the University of New Hampshire (Appendix C); and the records on file at the Lowell Building Department. GEC also relied on information provided in the Phase I Environmental Site Assessment (ESA), dated October 7, 2010, and the Phase I ESA updates, dated February 6, 2015 (excerpts in Appendix E), and August 17, 2015, which were completed by GEC.

2.1.1 Owner / Operator and Operations History

According to the Lowell Assessor's Office, the property is currently owned by Massachusetts Mills III LTDP PTN, which purchased the Site on June 2, 1988. No further chain of title history was available from the Assessor's Field Card. Additional ownership history was obtained from the Middlesex North District Registry of Deeds on-line records through www.masslandrecords.com. The additional ownership history is summarized in the table below.

Middlesex North District Registry of Deeds Records

Reference	Recording Date	Comment
Book 29636 Page 122	December 4, 2015	Lot 3A: Ownership of Picker building portion of original property was transferred to MM Picker LLC by Massachusetts Mills III Limited Partnership via Quitclaim Deed.
Plan Book 238 Plan 16	June 27, 2014	Lots 1, 2, 3A, 3B (subject property) and 4 are shown on "Plan of Land, Massachusetts Mills, 169.2 Bridge Street, Lowell, Massachusetts," prepared by R.E. Cameron & Associates, Inc., dated April 22, 2014. Based on this Plan of Land, Lot 3B is 47,218 square feet (1.084 acres) in area.
Book 4531 Page 78	June 2, 1988	Land that includes what will later be Lot 3B was transferred to Massachusetts Mills III Limited Partnership by Boott Mills via Quitclaim Deed.
Book 1333 Page 143	Unknown	Reference provided at Book 4531 Page 78, but could not be located. According to Book 4531 Page 78, the Lowell Industrial Development Corporation transferred the property to Boott Mills.

Additional information on prior ownership of the property is provided in subsequent paragraphs.

GEC reviewed available Sanborn Atlas maps for Lowell, dated 1977, 1952, 1950, 1907 and 1892. The property and vicinity were depicted in all of the maps. A summary of the findings on each of the Sanborn Atlas maps is provided below.

Map Year	Current Lot 3B (Boiler House and Courtyard)	Current Lot 3A (Picker Bldg.)
1977 (owner identified as Lowell Industrial Development Co., and that buildings are rented to various occupants)	Boiler room is shown with note "suspended steel and coal bunker (not used)"; courtyard shows oil pump ho., two fuel oil structures, and two G.T. (gas tanks); Lot 3B building next to Picker Bldg. is identified as Loft with a note "Box Toe Facty".	The Picker Bldg. is identified as two structures labeled "Loft".
1952 (same note as above)	Similar to 1977 map.	Similar to 1977 map.
1950 (same note as above)	Similar to 1952 and 1977 maps.	Similar to 1952 and 1977 maps.
1907 (occupied by Massachusetts Cotton Mills)	The Merrimack River is located where the Boiler House and courtyard would later be situated.	This building is labeled "Picker Ho"
1892 (occupied by Massachusetts Cotton Mills)	Similar to 1907 map.	Similar to 1907 map.

The 1907 Sanborn Atlas map depicts the Picker Building adjacent to the Merrimack River and no Boiler House. The property buildings and associated Mill buildings depicted are a part of the Massachusetts Cotton Mills. Topographic maps were available for 2012, 1987, 1966, 1950 and 1941. No buildings are depicted for the subject property on the 2012, 1987 or 1966 topographic maps. The 1950 and 1941 maps show the Picker building but do not show the Boiler House. Aerial photographs are available for 2012, 2010, 2008, 2006, 1998, 1995, 1985, 1980, 1978, 1965, 1963, 1952 and 1938. The Boiler House is shown on each of these aerial photographs, including that taken in 1938.

Based on the Historic American Engineering Record (HAER No. MA-89) for Massachusetts Mills, provided by the Mid-Atlantic Regional Office, National Park Service, U.S. Department of the Interior, Massachusetts Cotton Mills was first chartered in 1839 and operated until 1928. Initially the mill manufactured coarse white cotton cloth, until expanding manufacturing in 1893. According to HAER, the filled land was created sometime after authorization in 1882, and the Boiler House was constructed sometime between 1891 and 1911. After 1893, dyed goods, such as bed tickings and jeans, were manufactured. By 1926, more than 300 types of cloth were produced.

According to HAER, in 1927, Massachusetts Cotton Mills was terminated and became part of the Pepperell Manufacturing Company. Textile manufacturing at the mill complex stopped in 1928. In 1930, the Lowell Industrial Development Company took ownership of the mill complex, after which time, multiple entities occupied the mill complex, and used it for light industrial and warehousing uses.

The power plant was fueled by coal until the 1950's when it switched to no. 6 fuel oil stored in three underground USTs located on the Site property between the Boiler House and the Picker Buildings. The coal was stored in a coal bunker next to the Boiler House, in the courtyard. Until recently when the coal bunker was closed up to use a soil repository, the coal bunker opened up into the basement of the Boiler House.

GEC reviewed available city directories for the City of Lowell, dated 1942, 1948, 1954, 1960, 1966, 1971, 1976, 1981, 1986, 1995, 1998-99, 2003, 2008 and 2013. The following tables summarize historic property occupants. The property address was not listed as 150 Mass Mills Drive or 169.2 Bridge Street. Therefore, occupants listed may be occupiers of any of the eight Massachusetts Mill buildings during that time period. The Site is part of the umbrella address of 95 Bridge Street since 1942.

95 Bridge Street

Year	Listings
2013, 2008, 2003, 1999, 1995	No properties of environmental concern listed at or near the Site address.
1986	95 Bridge Street: Sullivan Brothers printers
1981	95 Bridge Street: Lowell Sheet Metal Eng., Sullivan Brothers printers
1976	95 Bridge Street: Sullivan Brother printers, Sullivan Ticket printers, Depoian Don Silk Screen
1971	95 Bridge Street: F.S. Payne Co. elevators, Robinson Top & Yarn Dye Works, Sullivan Brothers printers, Sullivan Ticket printers
1966	95 Bridge Street: Blue & White Print Company blueprints, Robert H. Jones printer, J.F. Murphy Co. printing, F.S. Payne Co. elevators, Robinson Top & Yarn Dye Works, Inc., Soms Distributors wholesale chemicals, Sullivan Brothers printers, Sullivan Brothers ticket printers, Superior Tool & Die Company
1960	95 Bridge Street: Art Serv Press printers, Blue & White Print Company blueprinting, Coated Products Corporation rubber goods manufacturing, The Creamer Corporation printers, J.F. Murphy Company printers, F.S. Payne Company elevator manufacturers, Robinson Top & Yarn Dye Works, Sullivan Brothers printers, Thomas the Master Cleaner
1954	95 Bridge Street: Art Service Press printers, Alexander Wool Combing Company wool scourers, Coated Products Corporation rubber good manufacturers, Gerald Leather Company, J.F. Murphy Company printers, F.S. Payne Co. elevators, Quinn Art Service sign printers, Robinson Top and Yarn Dye Works, Inc., Sullivan Brothers printers, Thomas the Master Cleaner
1948	95 Bridge Street: Art Service Press printers, Alexander Wool Combing Company wool scourers, Coated Products Corporation rubber goods manufacturers, Essex Chrome Plating Company, Hub Processing Company felt manufacturers, F.S. Payne Company elevator manufacturers, E.C. Pearson Company printers, Quinn Art Service sign printers, Robinson Top and Yarn Dye Works, Inc., Spector Wipe Supply waste dealer, Sullivan Brothers printers, Thomas the Master Cleaner, Inc.
1942	95 Bridge Street: Art Service Press printers, Alexander Wool Combing Company wool scourers, Coated Products Corporation rubber good manufacturers, Jonathan Holt & Company glue and roll covers manufacturers, Industrial Engineers welders, E.C. Pearson Company printers, Quinn Art Service sign printers, Riverside Dye House cleaners and dyers, Robinson Top and Yarn Dye Works, Inc., Sullivan Brothers printers, Thomas the Master Cleaner, Inc.

According to the *Report of Site Assessment, 95 Bridge Street, Lowell, MA*, dated July 14, 1987, by Geotechnical Consultants of Massachusetts, Inc., historically the Picker Building was occupied by Atlas Shoe (Section 10 and ½ of Section 9) and Lowell Rubber Co., Inc. (Section 11 and ½ of Section 9). In 1987, the Picker Building was occupied by the Lowell Paper Box Co, and used to manufacture small cardboard boxes. This process involved printing and cutting. According to this same report, the Boiler House was built in 1911 and was damaged by fire. In 1987, it was open to the elements.

The Boiler House and the courtyard are part of the same lot, which has been vacant for more than 63 years (i.e., since at least 1953) (based on a Historic Preservation Certification Application (Amendment F), dated November 24, 2003 and submitted to the Massachusetts Historical Commission by Commonweal Collaborative). The Boiler House was reportedly damaged by an explosion and fire on February 24, 1965 (The Lowell Sun newspaper article, Appendix F). The property map from the 1977 Lowell City Atlas depicts the Boiler House as "not used" (Appendix F). The Picker Building (Mill Building no. 3) is located on a separate lot and forms the southwest border of the courtyard. Mill operations in the Picker Building reportedly ceased many years ago. According to the 1974 City Directory, by that time, the Picker Building was vacant. The last known tenant was Universal Heel, which manufactured shoe heels, prior to that date. Note: Geotechnical Consultants, Inc. reported in their 1987 report that Lowell Paper Box Co. operated in the Picker Building at that time. This information conflicts with the information provided by Commonweal Collaborative.

Reportedly, pipes crossing overhead above the courtyard were wrapped in asbestos pipe insulation. In addition, asbestos was also reportedly present inside the Picker Building and were removed prior to beginning renovation activities. For the period July 2013 to August 2016, MassDEP's on-line Asbestos Project Lookup contains 11 listings of asbestos abatement projects for 150 Mass Mills Drive (http://public.dep.state.ma.us/Asbestos/asbestos.aspx). These projects occurred during the period August 14, 2015 to July 23, 2016, and included the removal of "caulk windows", pipe insulation and other debris. Whether any or all of these abatement activities were conducted inside the Picker Building is unknown. The abatement activities were conducted by Infinity Abatement Services Inc. and Acme Contractors Inc.

The courtyard is constructed on filled land at the confluence of the Merrimack and Concord Rivers. The soils within the courtyard, especially the shallower soils, appear to be comprised of significant amount of coal ash. The coal ash may have been placed throughout the courtyard, and may have originated from the Boiler House. The addition of coal ash appears to have raised the original (circa 1911) grade within the courtyard.

2.1.2 Oil and / or Hazardous Material Use and Storage History

Historical information regarding the types and quantities of OHMs used or generated, prior to Massachusetts Mills III Limited Partnership's acquisition of the property, is limited. Based on a review of Sanborn Fire Insurance Maps and City Directories, the property was historically part of The Massachusetts Cotton Mills until 1928, and subsequently the mill complex may have been operated as a wooden box manufacturer, printers, cleaners, silk screen printing shop, elevator manufacturers, yarn and dye works, wholesale chemical distributor, a machine shop, rubber goods manufacturing, leather goods, chrome plating, wool scourers, felt manufacturers, waste dealers, welders and a glue and covers manufacturer. OHM use associated with historic property usage likely included the use of petroleum products, solvents, cleaners, metals and paints.

The Disposal Site is contained within Lot 3B, which is occupied by the Boiler House and courtyard. The Boiler House was formerly used to generate power for the mill complex, from about 1911 to about 1953. It has been unused since that time, and was burned in a fire in 1965. Currently, it is partially open to the elements.

According to records obtained from the Lowell Fire Department no files for 169.2 Bridge Street or 150 Massmills Drive are available. The following permits were on-file for 95 Bridge Street; which of these permits apply to Lot 3B is unknown, unless explicitly stated:

- Permit issued to Gofkauf's Stores Inc. for the storage of 3,000 gallons of petroleum product, granted on October 6, 1931 with an expiration date of April 30, 1932.
- Permit issued to the Lowell Rubber Co. for the storage of 5,000 gallons of gasoline, granted on July 2, 1935 with an expiration date of April 30, 1936. [This gasoline storage may be that associated with the two courtyard gas tanks depicted in the 1977, 1952 and 1950 Sanborn Atlas maps, because Lowell Rubber Co. operated in the Picker Building. Two steel USTs (2,500 and 1,000 gallon capacity) were removed from the courtyard in early 2016. The UST removal is described in GEC's *IRA Plan Modification and Status Report*, submitted to MassDEP on April 19, 2016.]
- Permit issued to Gof-Kauf's Store Inc. for the storage of 156 gallons of alcohol in drums located in the northwest corner of the storeroom, dated November 2, 1945.
- Permit issued to the Lowell Industrial Development Co. for the storage of 100,000 gallons of Bunker C fuel oil in three tanks buried in the ground near the boiler room, dated June 28, 1955. [This storage is in the courtyard of Lot 3B. Based on information provided in the 1987 *Report of Site Assessment*, an employee of Boott Mills reported that the three abandoned bunkers were filled with concrete in 1978. GEC's subsequent investigation and excavation of one bunker did not find evidence of it being filled with concrete.]
- Permit issued to Coated Products Co. for the storage of 8,000 gallons of gasoline underground. A date of March 24, 1959 was listed on the card, but it was indicated that this was not the date of license issue. [It is unknown if this gasoline storage was in the two courtyard gas tanks depicted in the 1977, 1952 and 1950 Sanborn Atlas maps.]
- Permit issued to A. Rhodes Co. to keep, store, and use Class A liquids in an amount not exceeding 156 gallons on the street floor at the North end of the old Napping Building. This permit had no date.

No other removal information was available for these permitted uses.

Three Sanborn Atlas maps (1977, 1952 and 1950) depicted three fuel oil storage structures and two G.T. (gas tanks) in the courtyard. A Location Plan in the *Report of Site Assessment, 95 Bridge Street, Lowell, MA*, dated July 14, 1987, by Geotechnical Consultants of Massachusetts, Inc., also showed three fuel oil tanks but no gasoline tanks in the courtyard. This same report listed the following chemicals stored in the Picker Building by the Lowell Paper Box Co.: 200 pounds of ink and 55 gallons of solvent.

During the 2010 and 2015 Phase I ESA inspections of the Picker Building, courtyard and Boiler House, GEC made observations for equipment likely to contain PCB oil/fluid, such as electrical transformers, capacitors, hydraulic equipment and oil switches. Dry-type transformers typically do not contain PCBs. On the southwesterly exterior wall of the Picker building, GEC observed what appeared to be an old electrical transformer. The transformer was mounted on the wall five stories off the ground, so visual observations were limited. Based on its aged appearance, it is likely that this transformer contained PCBs.

Elevators are located in the Picker building; based on the age of the elevators, it is possible that PCB-containing hydraulic oil was previously utilized. Additionally, based on prior detections of PCBs in samples collected from oil-stained flooring and observed lubricating oil drums in the Picker building, it is likely that equipment utilizing PCB-containing oil was utilized throughout the Picker building during its past industrial uses. GEC also observed fluorescent light fixtures throughout the Picker building, and the associated ballasts are considered possible sources of PCBs based upon their potential ages. However, no obvious signs of fluid leakage were noted from their ballasts.

The Location Plan in the *Report of Site Assessment* showed several transformers marked "not active" near or on mill complex buildings, in 1987. However, none were shown associated with the Boiler House or in the courtyard. Two transformers were depicted near or on the Picker Building, on the other side of the building from the courtyard.

2.1.3 Waste Management History

Records of historic hazardous waste, waste oil or wastewater disposal practices at the property are limited. Sanitary waste was historically discharged to the sanitary sewer system. GEC did not identify any permits associated with waste disposal for the property.

According to the 1987 *Report of Site Assessment*, septic wastes from all users of the mill complex were discharged directly to the Merrimack River. For the Picker Building tenants, liquid wastes generated as part of industrial practices were discharged directly to the Merrimack River. No hazardous waste, waste oil or industrial wastewater is currently generated at Lots 3A or 3B.

2.1.4 Environmental Permits and Compliance History

Information on relevant local, state and federal environmental permits and OHM storage permits issued for the disposal site or on-site facilities, including any permit violations are provided below:

a. Permits for M.G.L. c. 21E Response Actions: RTN 3-33101, RTN 3-33474 and RTN 3-33853 have been assigned to releases at Lot 3B. A fourth RTN (3-33793) has been assigned to a release to the Concord River, related to oily sheen discharges from Lot 3B to the Concord River. On November 22, 2016, a combined IRA Plan for RTN 3-33853, IRA Plan for RTN 3-33793 and an IRA Plan Modification for RTN 3-33101 was provisionally approved by MassDEP. A RAM Plan was submitted on December 1, 2016 for RTN 3-33474.

b. Oil and/or Hazardous Material Storage Permits: Known historic OHM storage permits for Lot 3B are identified in Section 4.3 of this report. There is no known existing permitted OHM storage on either Lot 3A or Lot 3B.

c. Wastewater Discharge Permits: There are no known historic or current wastewater discharge permits for either Lot 3A or Lot 3B.

d. Groundwater Discharges Permits: There are no known historic or current groundwater discharge permits for either Lot 3A or Lot 3B.

e. Air Quality Discharges Permits: There are no known historic or current air quality discharge permits for either Lot 3A or Lot 3B, except as pertains to asbestos (see bullet "j" below).

f. Wetlands Alteration Permits: An Order of Conditions for Notice of Intent (206-0733) was issued by the Lowell Conservation Commission to R-M Developer, LLC (agent for Massachusetts Mills III Limited Partnership) on August 18, 2014. This Order of Conditions is for the renovation activities occurring on Lots 3A and 3B, including the courtyard.

g. Resource Conservation and Recovery Act (RCRA) Permits: There are no known historic or current RCRA permits for either Lot 3A or Lot 3B.

h. National Pollution Discharge Elimination System (NPDES) Permits: There are no known historic or current NPDES permits for either Lot 3A or Lot 3B.

i. Toxic Substances Control Act (TSCA) Permits: United States Environmental Protection Agency (USEPA) Region I determined that TSCA applies to the PCB cleanup in the courtyard. This EPA Risk-Based Application is being submitted in response to that determination.

j. Asbestos [310 CMR 7.15(14)]: A report, titled *Non-Traditional Asbestos Abatement Work Plan for the Remediation of Contaminated Soils* (NTWP), dated July 28, 2016, was submitted to the MassDEP Bureau of Air and Water (BAW) for the asbestos fibers located in the courtyard soils. This NTWP was prepared by Axiom Partners, Inc., on behalf of MM Picker LLC (agent for Massachusetts Mills III Limited Partnership). Subsequent revisions to the NTWP have been submitted to MassDEP BAW. The MassDEP BAW must approve the NTWP before the provisionally approved IRAs can be conducted.

k. Lowell Historic Permit: A Historic Permit (and Special Permit), dated May 12, 2012, was issued by the Lowell Historic Board to Massachusetts Mills III Limited Partnership (either directly or through one of its agents (R-M Developer LLC or MM Picker LLC)). These Historic and Special Permits are for the renovation activities that are underway.

2.1.5 Potentially Responsible Parties

The potentially responsible party for this release is the current owner, identified as follows:

Massachusetts Mills III Limited Partnership
c/o Joseph Mullins
31 Saint James Avenue, Ste. 940
Boston, MA 02116

2.2 Description of Releases / Nature of Contamination

Soils of the courtyard are contaminated with a mixture of OHM. Except for the petroleum hydrocarbons, the highest levels of specific OHM are detected in the original 0-3 foot interval soils and include the following: PCBs, asbestos, metals (especially vanadium) and carcinogenic PAHs. PCBs and asbestos are the principal OHM driving risk, as documented in Section 4.5, below. Lower levels of these same OHM are present in soils located in the original 3-6 foot interval. Subsequent to the remediation of the PCB hot spot, the levels of PCBs in the 0-1, 0-2 and 3-6 foot interval soils ranged up to 42, 25 and 6.3 mg/kg, respectively.

The original IRA Plan for RTN 3-33101 was submitted on October 20, 2015, and is intended to remediate petroleum contamination associated with the presence of greater than ½-inch of Non-Aqueous Phase Liquid (NAPL) in the subsurface. This condition constitutes a release to the environment pursuant to 310 CMR 40.0313(1) with a 72-hour reporting obligation. This condition was reported to the MassDEP on August 21, 2015. The NAPL was identified as no. 6 fuel oil associated with historic fuel oil bunkers in the courtyard.

Surficial renovation activities within the courtyard began at about the same time as, but independent of, the IRA remedial activities for RTN 3-33101, i.e., in early 2016. The renovation activities entailed the removal of soils from window wells and from the top one foot of soil over a portion of the courtyard, and stockpiling the soils until their disposition could be determined. On February 29, 2016, a soil sample collected from the stockpiled soils was disposal criteria tested, and found to contain 63 mg/kg PCBs (identified as Aroclor 1254), 23 mg/kg arsenic, 2,400 mg/kg lead, 3,500 mg/kg vanadium, 1,100 mg/kg zinc and 0.29 mg/kg heptachlor epoxide. Each of these hazardous materials was detected at a level exceeding its applicable RCS-1 Reportable Concentration. These stockpiled soils have since been properly disposed offsite (as part of the IRA).

On March 17, 2016, MassDEP was notified of the 120-day reportable condition, and the release condition was assigned RTN 3-33474. The access doors within the buildings and the fence gate are locked and signs are posted prohibiting access to the courtyard except by authorized personnel.

During the period March 14 to 30, 2016, after the results of the stockpile soil data were received indicating elevated levels of PCBs, metals and insecticides in soils, additional investigations of the soils throughout the courtyard were conducted to determine the horizontal and vertical extent of the contamination. This investigation encountered a small PCB hot spot with concentrations exceeding 50 mg/kg. The IRA remedial activities began during early March 2016, which included: the removal of the two USTs and confirmatory soil sampling; investigation of soils overlying, within and beneath the concrete fuel oil bunkers; and initial excavation of soils within the concrete bunkers.

During excavation of the soils within the FO-1 fuel oil bunker, as part of the IRA, oil was observed oozing into the excavation at a depth of approximately 5.5 feet below grade. Because of the shallow depth to the petroleum contamination, the discovery that no. 6 fuel oil bunker FO-1 is larger than anticipated, and the levels of PCB and metal contamination in shallow soils, a decision was made to deal with the PCB and metal contamination before continuing with petroleum remediation. Therefore an IRA Plan Modification, dated April 19, 2016, was submitted to the MassDEP outlining steps necessary to remediate the PCB and metal contamination before proceeding with the petroleum remediation.

RTN 3-33807 was assigned to a release identified as asbestos fibers in soils. This condition was reported to MassDEP on September 14, 2016, at the recommendation of the MassDEP Bureau of Air and Waste, so that the presence of asbestos fibers in soils could be remediated under the MCP rather than under the MassDEP Asbestos Program. A Reportable Quantity (1 pound) exists for asbestos; however, the condition in the courtyard is not consistent with the 2-hour release notification requirements specified at 310 CMR 40.0311, because the release is not "likely" to have occurred in a period of 24 consecutive hours or less. No Reportable Concentrations exist for asbestos. However, the asbestos release was reported as a 120-day release condition.

Subsequently, MassDEP requested that the asbestos release be reported as a 2-hour reportable condition, even though the mass of asbestos released and time period over which it was released is unknown. On October 12, 2016, a BWSC128 Release Notification form was submitted to MassDEP for the asbestos release, as a 2-hour reportable condition. RTN 3-33853 was assigned to this release. RTN 3-33807, assigned to the 120-day release notification for asbestos has been retracted. The IRA activities for RTN 3-33853 are consistent with the planned IRA activities for the metal- and PCB-contaminated soils, and are included in this EPA Risk-Based Application.

Asbestos fibers were discovered in the courtyard soils as a result of follow-up investigations required by the MassDEP Bureau of Air and Waste, following their inspection of the property on June 9, 2016 in response to a complaint due to dusts exiting a window of the Picker Building during interior renovation activities. Earlier, prior to the start of the renovation activities inside the Picker Building, an asbestos inspection and abatement program had been completed inside the building. The source of the asbestos in soils is uncertain; however, it may have originated from one or more of the following sources: (1) as a result of the historic fire in the Boiler House, which may have dispersed asbestos fibers from insulation within the building; (2) asbestos fibers blowing from the Boiler House, which has broken windows and is open to the courtyard; and / or (3) insulated pipes through the courtyard. The openings in the Boiler House, the asbestos-insulated pipes and demolition of a smoke stack in the courtyard will be addressed as part of a Non-Traditional Asbestos Abatement Work Plan, under the direction of the MassDEP Bureau of Air and Waste.

A new reportable release condition was discovered on September 8, 2016, when an oily sheen was observed seeping beneath the retaining wall of the courtyard into the Concord River. The oily sheen is likely attributable to the drop in the groundwater table as a result of the on-going drought. The tops of the groundwater table and surface water of the Concord River have dropped to below the bottom of the retaining wall separating the courtyard and river. Pursuant to 310 CMR 40.0313(4)(a), the presence of separate-phase oil on surface water is a Condition of Substantial Release Migration associated with RTN 3-33101, and is a separate 72-hour reportable condition. This condition was reported to MassDEP on September 8, 2016 and assigned RTN 3-33793. Although the IRA remedial activities for RTN 3-33793 are included in the conditionally-approved IRA Plan Modification document, they are not pertinent to the RAM or this EPA Risk-Based Application, and are excluded from this document.

A Phase I Initial Site Investigation and Tier Classification Submittal was submitted to MassDEP on August 29, 2016 for RTN 3-33101 and RTN 3-33474, at which time RTN 3-33474 was linked to RTN 3-33101 as a secondary release tracking number. Currently, due to one 2-hour and two 72-hour release notifications, IRA activities are required for RTN 3-33101, RTN 3-33793 and RTN 3-33853.

The conditionally-approved IRA Plan Modification document provided the following: (1) IRA Plan for RTN 3-33793 (oily sheen release to the Concord River); (2) IRA Plan for RTN 3-33853 (asbestos release); (3) the IRA Plan Modification No. 3 for RTN 3-33101 (NAPL in subsurface); and (4) the IRA Status Report No. 4 for RTN 3-33101 (NAPL in subsurface). The IRA Plans for RTN 3-33793 and RTN 3-33853 are included in the IRA Plan Modification for RTN 3-33101 because the releases are located within the same small courtyard, are at least partially commingled, and/or are the source of the oily sheen discharge to the Concord River.

At the request of the MassDEP Bureau of Air and Waste, which has regulatory authority over the asbestos contamination, the IRA Plans / IRA Plan Modification, submitted on November 2, 2016, describe the complete scope of the planned IRAs. This information is also provided in the RAM Plan and this EPA Risk-Based Application. Also, included in the IRA Plan Modification were risk assessments for construction workers and residential exposure to soils of the courtyard, and a Phase III Remedial Action Plan, which evaluates remedial options including the planned placement of PCB-, asbestos- and metal-contaminated soils in subsurface soil repositories and covering all existing courtyard soils (remaining following completion of the IRA and RAM) with a protective barrier. The risk assessments and Phase III Remedial Action Plan are also provided in the RAM Plan and EPA Risk-Based Application.

3.0 SITE DESCRIPTION AND SURROUNDING RECEPTORS

The property where the releases were encountered is located approximately 450 feet southeast of Bridge Street and just northeast of Massmills Drive in Lowell, Massachusetts. The property is a portion of a former mill complex, commonly known as Massachusetts Mills and is located along the Merrimack and Concord Rivers. The property includes a portion of the tax parcel presently identified by the City of Lowell as Lot 169.2 of Block 780 on Map 177, and it is identified as Lot 3B on a Plan of Land of Massachusetts Mills, prepared by R.E. Cameron & Associates, Inc. and dated April 22, 2014. According to available records from the City of Lowell and the North Middlesex Registry of Deeds, the property may be addressed as 169.2 Bridge Street or 150 Massmills Drive. It was previously identified under an umbrella address of 95 Bridge Street. Refer to Figure 1 Site Locus and Figure 2 MassDEP Phase I Site Assessment Map. A Site Plan is provided as Figure 3.

The property consists of an irregularly-shaped, 47,218-square-foot area of land improved with a portion of a three-story brick building, which was formerly utilized as the Boiler House building for the mill and will hereafter be referred to as the "Boiler House." The Boiler House occupies approximately 40% of the property. The property also includes a courtyard south of the Boiler House and the adjacent property. The entire Boiler House is currently vacant and unused. According to the Site contact, the Boiler House building will be redeveloped eventually but there are no plans at present.

The location where the release was encountered (Disposal Site or Site) is located within the triangular shaped courtyard between the Boiler House building to the north and the Picker building to the south, and the Concord River to the east. Please refer to Figure 3.

The Site vicinity contains vacant former mill buildings and redeveloped former mill buildings that are currently used for multi-tenant residential housing. Lots 3A and 3B abut the south side of the courtyard, and are occupied by the Picker Building. The portion of the Picker Building on Lot 3A is currently being redeveloped into a residential apartment building, and the portion of the Picker Building on Lot 3B is being razed to develop parking space for the new residential apartments. Although the courtyard is on the subject property, it will be used as passive open space for future residents on the adjacent property.

The Universal Transverse Mercator (UTM) coordinates of the Site are 5258337 meters north and -7937439 meters east. The topography of the Site is generally flat but gently slopes downward toward the northeast (Merrimack River), east, and southeast (Concord River). The elevation of the Site is approximately 55 to 65 feet above Mean Sea Level (MSL). On the east side of the courtyard, a retaining wall separates the courtyard from the Concord River. The Picker Building bounds the courtyard to the south, and the Boiler House to the north and west. The Merrimack River is located north of the Boiler House.

The MassDEP Phase I Site Assessment Map (Figure 2) indicated no Areas of Critical Environmental Concern (ACECs), Certified or Potential Vernal Pools, or Outstanding Resource Waters located in the vicinity of the Site. Additionally, the Site is not mapped within the boundaries of a Potentially Productive Aquifer (PPA), Sole Source Aquifer (SSA), Zone A of a Surface Water Supply Protection Area, Zone II of a public water supply well, an Interim Wellhead Protection Area (IWPA) or within the boundaries of a Non-Potential Drinking Water Source Area.

The property is located within a FEMA 100-year floodplain. The nearby Merrimack River is denoted as containing Rare Wetland Wildlife Habitat. Additionally, Protected Open Spaces are situated approximately 475 feet north, 500 feet west-southwest, and 560 feet northeast of the property.

Based on the Flood Insurance Rate Map (FIRM) Middlesex County Panel 250170143F, dated July 7, 2014, the Site is located within the 1% annual chance floodplain with a base flood elevation of 66 feet.

In the vicinity of the property, the Merrimack River generally flows from northwest to southeast, and the Concord River generally flows from south to north. In this area, the Merrimack River is a Class B (Warm Water, Treated Water Supply, CSO) water body according to Table 20 of the Massachusetts Surface Water Quality Standards [314 CMR 4.00]. At its confluence with the Merrimack River, the Concord River is a Class B (Warm Water, CSO) water body according to Table 18 of the Massachusetts Surface Water Quality Standards. Class B water bodies are designated as a habitat for fish, other aquatic life and wildlife, and for primary and secondary contact recreation. Class B (Warm Water) water bodies are subject to dissolved oxygen and temperature criteria for warm water fisheries [310 CMR 4.06(1)(d)(7)]. Class B (Treated Water Supply) water bodies denotes those Class B waters that are suitable for use as a source of public water supply after appropriate treatment [310 CMR 4.05(3)(b) and 4.06(1)(d)(6)]. Class B (CSO) means these waters are identified as impacted by the discharge of combined sewer overflows; however, a long term control plan has not been approved or fully implemented for the CSO discharges [310 CMR 4.06(1)(d)(10)]. Class B (CSO) water bodies occasionally are subject to short-term impairment of swimming or other recreational uses due to untreated combined sewer overflow discharges in a typical year, and the aquatic life community may suffer adverse impact yet is still generally viable [310 CMR 4.06(1)(d)(11)].

The surrounding areas are serviced by the municipal potable water supply. The Picker building is slated to be serviced by the municipal water and sewer services upon completion of the renovation/ rehabilitation. Based on the MassDEP Phase I Assessment Map (Figure 2), the property is not located within a potential or actual drinking water source area. Based on a search of MassDEP's SearchWell database, no private potable water supply wells are located within 500 feet of the Disposal Site. Refer to Appendix F for the results of the domestic water supply well search on the SearchWell database [http://public.dep.state.ma.us/searchwell/].

4.0 INVESTIGATIONS, ASSESSMENTS AND REMEDIAL ACTIVITIES CONDUCTED TO DATE

The investigations, assessments and remedial activities described below were mostly conducted: (1) as part of due diligence activities; (2) investigations for RTNs 3-33101 and 3-33474; and (3) as part of remedial activities for RTN 3-33101. Some of the asbestos investigations were conducted as required by the MassDEP Bureau of Air and Waste, and as follow-up asbestos investigations for RTN 3-33853. Finally, some of the investigations were conducted as part of RTN 3-33793 following discovery of the oily sheen on the Concord River.

With one exception, the reports identified below were submitted to MassDEP, and provide the investigations, assessments and remedial activities in Section 4.0. One of the risk assessments provided in Section 4.5 is prepared specifically for this EPA Risk-Based Application, and documents the development of Site-specific risk-based PCB cleanup standards.

1. IRA Plan for RTN 3-33101, submitted October 20, 2015;
2. IRA Status Report for RTN 3-33101, dated December 15, 2015;
3. IRA Plan Modification and Status Report no. 2 for RTN 3-33101, submitted April 19, 2016;
4. IRA Plan Modification no. 2 and Status Report no. 3 for RTN 3-33101, submitted August 15, 2016;
5. Phase I Initial Site Investigation, Phase II Scope of Work and Tier Classification Submittal for RTN 3-33101 and 3-33474, submitted August 29, 2016;
6. IRA Plans for RTN 3-33853 (asbestos) and RTN 3-33793 (oily sheen in river), IRA Plan Modification no. 3 for RTN 3-33101 and IRA Status Report no. 4 for RTN 3-33101, submitted November 2, 2016;
7. Phase III Remedial Action Plan for RTNs 3-33101, 3-33474, 3-33793 and 3-33853 (in support of IRA Plans / IRA Plan Modification submitted on November 2, 2016); and
8. RAM Plan for RTN 3-33474, submitted on December 1, 2016.

4.1 Standard Operating Procedures and Laboratory Analytical Reports

The investigations described in Section 4.2 were conducted in accordance with GEC's Standard Operating Procedures, and consistent with applicable MassDEP and USEPA policies and guidance. GEC's Standard Operating Procedures are provided in Appendix G.

Except for certain soil samples analyzed for asbestos, all samples collected for analysis were submitted under chain-of-custody documentation to Con-Test Analytical Laboratory (Con-Test), of East Longmeadow, Massachusetts. With the exception of some soil samples collected for disposal criteria testing, soil samples collected for PCB analysis were analyzed via USEPA Method SW846 8082 with Soxhlet extraction. Select soil samples were analyzed for PCB congeners via USEPA Method SW846 8270M. Laboratory reports for the investigations described below are compiled in Appendix H.

4.2 Description of Investigations and Remedial Activities

The investigations and remedial activities conducted from August 21, 2015 to August 10, 2016 are described in Section 4.2.1. The investigations conducted after August 10, 2016 are described in Section 4.2.2.

Test boring and soil sampling locations are depicted on Figure 4 for the courtyard and Picker Building, Figure 4A for the B-11 PCB hot spot, Figure 4B for the gasoline UST and FO-1 fuel oil bunker area, and Figure 4C for the B-9 PCB contaminated area. Figure 4A also depicts the excavation area and confirmatory sampling locations for the B-11 PCB hot spot. Figure 5 shows the current condition of the courtyard, including the location of the utility vault, four dry wells, coal chute, and the following areas that have been excavated to date: (1) extreme eastern portion of courtyard (from the Boiler House to the north to the Picker Building to the south, and from the fuel oil bunker to the west to the retaining wall to the east) (excavated 3 feet below grade); (2) eastern portion of courtyard (between the fuel oil bunker to the east and the smoke stack to the west, and from the Boiler House to the north to the Picker Building to the south) (excavated to 1 foot below grade); (3) the B-11 PCB hot spot (excavated to 1.5 feet below grade); and (4) the west end of the courtyard (from just east of the utility vault to dry well no. 2 to the east).

Summaries of analytical data are provided in Tables 1 to 5, 6.1 to 6.4, 7 and 8. The courtyard soil analytical data are provided in Table 1, the groundwater analytical data are provided in Table 2, the Picker building soil data are provided in Table 3, the stockpiled soil analytical data are provided in Table 4, the water analytical data from the gasoline USTs are provided in Table 5, the PCB congener data for soil samples are provided and interpreted in Tables 6.1 to 6.4, and the asbestos analytical data for soil samples are summarized in Table 7. The analytical data for river water are summarized in Table 8. Analytical reports are provided in Appendix H. Boring logs for all test borings advanced to date are provided in Appendix I.

The interpretation of the analytical data are provided in Section 4.3.

4.2.1 Period: August 21, 2015 to August 10, 2016

The period from August 14 to 18, 2015 covers the due diligence period, prior to release notification. During this period, a Limited Site Investigation (LSI) was conducted, entailing advancement of test borings and installation of monitoring wells. On August 14, 2015, New England Geotech, LLC (NEG), under the supervision of GEC personnel, performed four soil test borings (designated B-1 to B-4) and installed three groundwater monitoring wells (designated GEC-1 to GEC-3) in the courtyard area of the Site. One soil boring (B-2) was only completed to 11 feet below surface grade (BSG) due to refusal after several attempts, while the remaining borings were advanced to between 20 and 25 feet BSG.

Test borings were advanced using a track-mounted, direct-push GeoProbe® 6620DT drill rig. Soil samples were collected continuously, utilizing clean, acetate sleeves inside hollow, steel rods. The sleeves were five feet in length, and a new sleeve was used for each sample collected. Soil from each sampling interval was headspace screened for total ionizable compounds using an Ion Science TIGER photoionization detector (PID) equipped with an 10.6 eV lamp. PID readings ranged from 0.0 to 0.1 parts per million per unit volume (ppmv).

During test boring activities, wet soils (indicative of the apparent water table) were encountered at depths ranging from 13 to 20 feet BSG. Urban fill materials were observed in each test boring. Petroleum staining and a petroleum odor were noted at approximately 19 feet BSG in B-1. A petroleum sheen and free product were noted at approximately 19 feet BSG in B-3. A petroleum sheen and petroleum odor were noted at approximately 17.5 feet BSG in B-4, and possible gleying was noted below the petroleum contamination in these test borings.

Monitoring wells were installed in test borings B-1, B-3, and B-4 and designated GEC-1, GEC-2, and GEC-3, respectively. The monitoring wells were constructed using ten to fifteen feet of 2-inch I.D., Schedule 40 PVC ten-slot (0.010" slots) screen followed by varying lengths of solid PVC riser pipe. The borings were backfilled with clean silica sand to approximately one foot above the screen, followed by a bentonite seal and secured at the ground surface using 4-inch internal diameter steel standpipes.

To ensure an acceptable hydrologic connection between the wells and surrounding substrata and to remove fines, the wells were developed using a Solinst 410 peristaltic pump.

Due to slow recharge in the wells, only one gallon was purged from each during well development. GEC noted visual evidence of a petroleum sheen on purge water from all of the monitoring wells. Refer to the Appendix J for the boring logs / well construction diagrams for additional test boring and monitoring well construction information.

On August 14, 2015, GEC collected soil samples from test borings B-1, B-3, and B-4 for laboratory analysis for extractable petroleum hydrocarbons (EPH), including target polycyclic aromatic hydrocarbons (PAHs), and volatile petroleum hydrocarbons (VPH), including target volatile organic compounds (VOCs), via the MassDEP Methods. Composite samples were collected from the 15-20' interval in each boring, since this depth range contained evidence of petroleum contamination. In order to determine the type of petroleum contamination encountered, GEC collected discrete samples of petroleum stained soil and/or free product from test borings B-3 and B-4 for petroleum fingerprint analysis via USEPA Method 8015C. The fingerprint analysis sample from B-3 was collected from a three-inch soil interval located at a depth of approximately 19.5' BSG. The fingerprint analysis sample from B-4 was collected from a three-inch soil interval located at a depth of approximately 18.5' BSG. Refer to Table 1 for a summary of the soil analytical data.

On August 19, 2015, GEC returned to the Site to collect groundwater samples from the newly installed monitoring wells. An attempt was also made to gauge the wells using a Solinst (Model 122) oil/water interface probe to determine if NAPL or free-product was present. Since test boring / monitoring well B-1/GEC-1 showed the least evidence of contamination during test boring / well installation activities, GEC gauged this well first. The depth to bottom (DTB) of GEC-1 was measured at 21.97 feet, but the interface probe did not beep or emit a steady tone. Upon retrieving the probe from the well, GEC observed a dark brown, viscous petroleum NAPL coating the tape from approximately 2.4 feet to 0.7 feet. GEC attempted to collect a sample of the petroleum NAPL using a disposable polyethylene bailer; however, the NAPL was too viscous and would not enter the bailer. GEC was able to collect a groundwater sample from GEC-1 using the bailer; this sample was submitted for laboratory analysis for EPH, including target PAHs, via the MassDEP Method. Despite the foregoing, and based on visual observations made during test boring / soil sampling activities, GEC concluded that greater than ½-inch of petroleum NAPL was present in the subsurface.

No visual evidence of NAPL was observed at B-3/GEC-2 or B-4/GEC-3. DTB was 25.27 feet at GEC-2 and 26.20 feet at GEC-3. Depth to water (DTW) was 22.70 feet at GEC-2 and 19.87 feet at GEC-3. Groundwater samples were collected from GEC-2 and GEC-3 using a Geotech peristaltic pump. Due to the slow groundwater recharge rate at GEC-2 and GEC-3 – noted during well development – the monitoring wells were not purged prior to sample collection. GEC-2 went dry during sampling, so GEC was only able to collect a groundwater sample for analysis of EPH, including target PAH, via MassDEP's method. GEC was able to collect groundwater samples from monitoring well GEC-3 for analysis of EPH and PAHs, and of VPH and target VOCs via MassDEP's methods. Groundwater from both GEC-2 and GEC-3 appeared slightly cloudy with evidence of apparent petroleum sheen. The groundwater analytical data are summarized in Table 2.

Of note: the three monitoring wells that were advanced during this investigation were subsequently demolished, sometime between August and October 2015, by the rehabilitation / renovation activities that were on-going at the Site.

4.2.2 Period: August 21, 2015 to August 10, 2016

The period from August 21, 2015 to August 10, 2016 covers the period from the start of IRA activities for RTN 3-33101 through the IRA Status Report no. 3 period for RTN 3-33101. The last IRA Status Report for RTN 3-33101 was submitted on August 15, 2016. IRA activities have been conducted since August 21, 2015 for RTN 3-33101, starting with assessment only activities.

The investigations and remedial activities for this IRA are described below for the period through August 10, 2016. The analytical data were collected during this portion of the IRA for the following reasons: (1) to determine if the petroleum contamination extended beneath the Picker building; (2) to determine whether significant petroleum contamination existed at the side walls and bottoms of the two gasoline UST tank graves; (3) to obtain disposal criteria data for stockpile SP-1, which was generated when the renovation contractor cleaned out window wells and scraped the surface of the ground; (4) to obtain information on the horizontal and vertical extent of PCB, metal, insecticide, petroleum and PAH contamination in the 0-11 foot interval soils across the courtyard and in the gasoline UST graves, in part to determine whether the PCB/metal/insecticide contamination was commingled with the petroleum contamination; (5) to determine the proportion of the PCB contamination that contains dioxin-like toxicity; (6) to determine whether the water inside the UST tanks contained PCBs; and (7) to determine the residual levels of PCBs in soils following excavation of the B-11 PCB hot spot. At the request of MassDEP, Axiom Partners Inc. (Axiom), of Wakefield, Massachusetts collected soil samples for analysis of asbestos (described in more detail below).

The original planned IRA entailed two remedial phases and one investigative phase: (1) the removal of the two USTs, including the excavation of petroleum-contaminated soils associated with the UST closure and confirmatory sampling of sidewall and bottom samples; (2) the excavation of sands located within the two concrete fuel oil bunkers, the confirmatory sampling to delineate the extent/presence of petroleum impacts and either the removal or closure in place of the concrete bunkers; and (3) the advancement of test borings and installation of monitoring wells near existing monitoring well GEC-1 and the USTs and concrete fuel oil bunkers to determine the extent of petroleum-related contamination. The IRA Plan (October 2015) assumed the excavation of up to 1,000 cubic yards of petroleum-contaminated soils for either off-site recycling or off-site disposal and the removal of up to 10,000 gallons of oily water for treatment. Based on available soil and groundwater data and boring logs, the petroleum-related contamination was believed to be located more than 15 feet below grade. Refer to Figure 3 for the locations of the former USTs (identified as GT-1 and GT-2) and existing concrete bunkers(s) (identified as FO-1).

Advancement of Test Borings and Installation of Soil Vapor Points in Picker Building

On February 12, 2016, GEC conducted a limited subsurface investigation beneath the Picker Building. GEC was joined by New England Geotech LLC (NEG), of Smithfield, Rhode Island, to advance borings using a hand-held GeoProbe in an attempt to reach the groundwater table and assess if the no. 6 fuel oil contamination extended under the building. Six hand borings were advanced within the basement of the Picker Building. Refusal was encountered prior to reaching the groundwater table. Therefore, each of these borings was completed as a soil vapor point instead of a monitoring well, so that soil vapor sampling and analysis could be conducted in the future. This work was done in advance of the basement being filled with approximately six feet of "flow-able concrete". Therefore, the soil vapor points were constructed similar to monitoring wells. They were each constructed with five feet of screen from the bottom of the foundation floor to five below the floor. Because the basement will be renovated with six-feet of flow-able concrete and a vapor barrier and a radon system, a riser was installed from the top of each well screen to near the ceiling of the basement. The radon system is being installed in the basement beneath the future residences, because there is a known radon issue in this area of Lowell. It is not being installed to address vapor intrusion issues from contamination present in soils or groundwater at the Site.

Due to the limits on the hand-held GeoProbe, the borings could not be advanced to the water-table, as originally planned. The maximum depth achieved was 7.5 feet below the basement floor. The soils beneath the Picker Building consist of fill containing fine sand and silts, with coal, brick and ash. Soil samples were collected from each boring and submitted to Con-Test under chain of custody for analysis of EPH and PAHs via MassDEP's method and VPH and target VOCs via MassDEP's method. No EPH subset was detected in any soil sample above a potentially applicable Method 1 S-1 soil standard. Several PAHs were detected in one soil sample at levels above their potentially applicable Method 1 S-1 soil standards. For the remaining soil samples, all PAHs were detected at levels less than their potentially applicable Method 1 S-1 soil standards. Likely the PAHs are attributable to coal ash present in the soils. VPH or target VOCs (except for naphthalene, which is a PAH) were not detected in any soil sample collected beneath the Picker Building. These soil analytical data are provided on Table 3. The sampling locations are provided on Figure 4. The placement of flow-able concrete was completed on February 25, 2016. These borings and soil vapor points are referred to as HB-1/SVP-1 to HB-6/SVP-6.

GEC had anticipated returning to screen each soil vapor point and collect soil vapor samples for analysis of air petroleum hydrocarbons (APH) and target VOCs. However, these soil vapor points were destroyed during the interior demolition work occurring in the Picker Building. Given that (1) little to no VOCs or VPH were detected in soil, (2) depth to groundwater is more than 15 feet below grade and (3) the NAPL is comprised of non-volatile no. 6 fuel oil, vapor intrusion is likely not a significant migration pathway at this Site.

Discovery and Sampling of Stockpile SP-1

On February 29, 2016, GEC returned to the Site for a safety/ logistics meeting with the subcontractor (ENPRO Services, Inc. (ENPRO) of Salisbury, Massachusetts) hired to remove the gasoline USTs. During this meeting GEC and ENPRO noted a stockpile (designated SP-1) of approximately forty cubic yards (40 CY) of soil and debris from the courtyard that had been placed over the location of the proposed UST removal. Subsequent conversations with the General Contractor, Dellbrook, lead to the determination that this soil stockpile would need to be removed from the Site.

On February 29, 2016, GEC collected eight discrete soil samples from eight locations of the stockpile approximately twelve to eighteen inches into the stockpile bulk and homogenized them into a single composite sample, which was then submitted under chain of custody to Con-Test, for disposal criteria analysis. This consisted of the following analyses: ignitability via USEPA Method 1030, specific conductance via USEPA Method 2510B, VOCs via USEPA Method 8260C, total petroleum hydrocarbons (TPH) via USEPA Method 8100M, semi-volatile organic compounds (SVOCs) via USEPA Method 8270D, MA14 metals via USEPA Methods 6010C/7471B, TCLP (toxicity characteristic leaching procedure) cadmium and TCLP lead via USEPA Method 6010C/1311, reactive sulfide via USEPA Method 9030A, reactive cyanide via USEPA Method 9014, PCBs with Soxhlet extraction via USEPA Method 8082A, pesticides and herbicides via USEPA Methods 8081B and 8151A, and TCLP heptachlor via USEPA Method 8081B/1311. On March 10, 2016, GEC collected a sample from SP-1 for analysis of hexavalent chromium, pH and oxygen-reduction potential (ORP) via USEPA Methods 7196A/SM2580 A/9045C.

Based on the analytical results for SP-1, elevated levels of PCBs, several metals and heptachlor epoxide were detected, and a new 120-day reportable condition was identified (assigned RTN 3-33474). The analytical data is summarized in Table 4.

Gasoline UST Removal

On March 7, 2016, ENPRO, under the oversight of GEC, began the removal of the two gasoline USTs. A safety meeting was conducted, soil erosion control measures were put in place to restrict any soils from leaving the Site, and the Fire Department was notified that the UST removal project was beginning. Lt Mello, of the Lowell FD was on-Site during the removal of overburden soils and the locating of the steel USTs. ENPRO determined that approximately 300 gallons of water/gas was still present in the USTs. GEC collected a water sample from each of the USTs, using a Solonist 410 peristaltic pump. These water samples, designated GT-1 and GT-2, were submitted to Con-Test under chain of custody for analysis of PCBs via USEPA Method 8082A, to determine whether the tank water was acceptable to send to Cyn Environmental Services. No PCBs were detected (Table 5). Refer to Appendix J for the disposal records for the tank water.

The following day, March, 8 2016, ENPRO proceeded to inert the USTs and cut a hole in the top of the USTs to remove the water/gas mix from within the USTs and placed this liquid in a 250-gallon tote for temporary storage and subsequent transport. Lt Mello of the Lowell FD returned to the site to observe the removal of the USTs from the tank grave. Once the USTs were removed from the tank grave, they were placed on poly-sheeting, to ensure that contact with the existing soils was minimized. There was no olfactory or visual evidence of a petroleum release in the tank graves. Soils collected from the sidewalls and bottom of the tank graves were headspace screened using a MiniRae 300 PPM PID equipped with a 10.6 eV lamp. The headspace readings ranged from 0.0 to 5.9 ppmv. GEC collected sidewall and bottom samples from around each of the USTs. The sample locations and depths are as follows: Gas Tank 1 (GT-1) northern sidewall (NSW-GT-1) (3-4') below surface grade (BSG), east sidewall (ESW-GT-1) (3-4' BSG), south sidewall (SSW-GT-1) (3-4' BSG) and a bottom sample BTM-GT-1 (6' BSG); Gas Tank 2 (GT-2) NSW-GT-2 (5-6' BSG), west sidewall (WSW-GT-2) (5-6' BSG), SSW-GT-2 (5-6' BSG) and BTM-GT-2 (8' BSG); the depths vary between tanks due to the varied size of the USTs. GT-1 was approximately four feet (4') in diameter and ten and one-half feet (10.5') long. GT-2 was six foot (6') in diameter and twelve feet (12') long. These soil samples were submitted to Con-Test for analysis of EPH and PAHs via MassDEP's method, VPH and target VOCs via MassDEP's method, PCBs via USEPA Method 8082A, pesticides via USEPA Method 8081B and MA14 metals via USEPA Methods 6010C/7471A.

The sidewall and bottom sampling locations are depicted on Figure 4B and the analytical data are summarized on Table 1. No elevated levels of EPH, VPH or target VOCs were detected in the sidewall or bottom soil samples. One sidewall sample (NSW-GT-1) had elevated levels of PAHs, which may be due to the presence of coal ash in the soils, a prevalent condition throughout the courtyard. Of the metals, only lead was detected at concentrations (up to 220 mg/kg) above its Method 1 S-1/GW-x standard (100 mg/kg), which is common in the shallow courtyard soils. PCBs were detected at levels ranging from <0.11 to 6.3 mg/kg, also consistent with courtyard soils. Chlordane and dieldrin were also detected at levels less than 1 mg/kg. Based on the results of PID screening, visual and olfactory observations, and confirmatory soil sampling, there is no evidence of a gasoline release from these USTs. In addition, there is no evidence that the no. 6 fuel oil release has impacted the tank grave. The soil contamination that is present is consistent with that observed in shallow soils (i.e., soils less than 15 feet below grade) throughout the courtyard.

On March 9, 2016 GEC and ENPRO collected wipe samples from the exterior of each of the steel USTs to determine if the soils that had been in contact had left residual PCBs on the tank walls. ENPRO submitted the wipe samples under chain of custody to Alpha Analytical, of Westborough, Massachusetts, for analysis of PCBs via USEPA Method 8082A. No PCBs were detected; therefore, the tanks were determined to be suitable to be sent off-site for recycling.

On March 16, 2016 GEC returned to the Site to oversee the removal of the steel USTs from the courtyard. The wipe samples collected on March 9, 2016 came back as non-detect. The USTs were cleaned again and transported to Windfield Alloy Inc., of Lawrence Massachusetts, for recycling. Refer to Appendix J for disposal records.

The tank graves were lined with poly-sheeting, and the overburden from above the tanks was placed in the tank grave. Another layer of poly-sheeting was placed on top of this material, then approximately 10 cubic yards from above the bunkers was placed on this poly-sheeting. This was done so that the loader could move over this area to place other soils from the top of the bunkers into stockpile SP-2.

<u>Investigations associated with Fuel Oil Bunker</u>

Based on prior investigations, the fuel oil bunkers were known to contain sands that were distinctly different from the overlying soil. At the top of the bunker, the sands did not appear to be contaminated with fuel oil. Additional investigations were conducted to determine if the sands were contaminated with PCBs, metals or insecticides detected in the shallow courtyard soils.

On March 9, 2016 GEC and ENPRO advanced test pit TP-FO-1 at fuel oil bunker FO-1. The overburden soils above the fuel oil bunker FO-1 were collected from the test pit at the following intervals: 0-1 foot, 1-2 foot and 2-3 foot. Once the sands within FO-1 were encountered, GEC collected a discrete sample of the sand from within the bunker at approximately 3.5' BSG, where it was apparent that the sands were undisturbed (i.e., there had been no mixing of the overburden soils and the sands within the bunker. The three samples collected from above the FO-1 were submitted to Con-Test under chain of custody for the following analyses designated FO-1-TP (0-1'), (1-2') and (2-3'): MA14 metals via USEPA Method 6010C/7471A; PCBs with Soxhlet extraction via USEPA Method 8082A; and pesticides via USEPA Method 8081B. The sand sample (designated FO-1 (3')) collected from just inside the top of the bunker (located 3.5 feet below surface grade) was submitted to Con-Test under chain of custody for analysis of EPH and PAHs via MassDEP's method, VPH and target VOCs via MassDEP's method, MA14 metals via USEPA Method 6010C/7471A, PCBs with Soxhlet extraction via USEPA Method 8082A, and pesticides via USEPA Method 8081B.

On March 10, 2016, GEC and ENPRO continued the test pit TP-FO-1 in FO-1 to collect samples from the tank bottom (5.5') (designated FO-1-BTM) and below the tank bottom (7-8') (designated FO-1), which were submitted for the following analyses: VPH and target VOCs via MassDEP's method; total petroleum hydrocarbons (TPH) via USEPA Method 8100M; MA14 metals via USEPA Method 6010C/7471A; PCBs with Soxhlet extraction via USEPA Method 8082A; pesticides via USEPA Method 8081B; and herbicides via USEPA Method 8151A. TPH was detected at 31 and 33,000 mg/kg at 5.5 feet and 7-8 feet, respectively, at FO-1. PCBs were detected at <0.11 and 0.45 mg/kg, respectively. The analytical data for TP-FO-1 are summarized in Table 1, and the test pit location is depicted on Figures 4 and 4B.

<u>Fuel Oil Bunker Remediation</u>

On March 28, 2016, GEC and ENPRO returned to the site to excavate the no. 6 fuel oil bunkers (FO-1 and FO-2). The PCB-containing soils lying atop of the FO-1 bunker were stockpiled between the pump house and the smokestack. This stockpile is identified as SP-2, and had a volume of approximately 25 cubic yards.

As a result of the excavation, GEC discovered that the previously believed dimensions of the FO-1 bunker were not correct. Based on early observations on March 28, FO-1's initial adjusted dimensions were believed closer to forty-two feet long, eight feet wide and five and one-half feet deep (42' x 8' x 5.5'). ENPRO removed the contents (sands) of this bunker and stockpiled them adjacent to the smokestack; this stockpile is identified as SP-3. SP-3 is estimated to be approximately 20 cubic yards.

Lt. Mello of the Lowell Fire Department was present for a portion of the excavation and was informed of the presence of PCBs in the courtyard. He advised posting additional signage warning of the presence of the PCBs, and stated that he would alert the Fire Department to the added hazards in the courtyard.

GEC and ENPRO continued excavating. The bottom of the bunker wall was encountered at approximately 4.5 feet below grade. Petroleum-impacted soils based on visual and olfactory observations at approximately 5.5 feet below ground surface or approximately 1 foot below the bottom of the wall. These petroleum-impacted soils were placed in a separate stockpile, estimated to be less than 10 cubic yards.

During the course of excavation, the adjusted dimensions of the FO-1 bunker were also determined to be incorrect. ENPRO dug to a depth of 5.5' BSG on one side of FO-1 and discovered a concrete structure angled such that it began at the base of the wall and continued downward to a depth of at least 8' BSG. It was at this time that the client, the LSP (Brian Butler of GEC) and the General Contractor (Dellbrook) were contacted to inform them of the developments and receive additional instructions. Because the petroleum contamination was encountered at a shallower depth than anticipated and because the FO-1 bunker dimensions are much larger than anticipated, a determination was made that additional excavation could not occur given the complicated conditions, which included the presence of elevated levels of PCBs and metals in soils overlying the bunker. A decision was made to remediate the PCB- and metal-contaminated soils prior to continuing the remediation of the FO-1 and FO-2 bunkers.

GEC and ENPRO returned on the following day to replace the soils previously excavated from FO-1. The petroleum-impacted soils were returned to the original depth and the stockpiled sands (SP-3) were placed back into the bunker, on top of the petroleum-contaminated soils.

<u>Shallow Soil Sampling across Courtyard (March 2016)</u>

Investigations in the courtyard were conducted to determine the distribution of PCBs, metals and other oils and hazardous materials in soils, and to determine the type and concentration of dioxin-like PCB congeners. On March 11, 2016, GEC returned to the Site to lay out seven boring locations utilizing a three-meter assessment grid running north to south and east to west. The boring locations were placed on intersections on the grid, selected to obtain representative soil samples from the courtyard. On March 14, 2016, GEC and NEG advanced the seven borings using a 6622DT track-mounted GeoProbe rig. For each boring (as Site conditions allowed), soil samples were collected from the following intervals: (1) 0-1 foot interval; (2) 1-3 foot interval; (3) 3-6 foot interval; and (4) 6-11 or 6-9 foot interval. B-6 was in the same location as TP-FO-1 (see above for details on TP-FO-1). Refer to the following table for a summary of the analysis performed:

Location	Depth	PCBs (with Soxhlet extr.)	PCB Congeners	EPH w/ PAHs	MA14 Metals	Pesticides / Herbicides
B-5	0-1'	X	X			
B-5	1-3'	X		X	X	X
B-5	3-6'	X				

B-5	6-11'	X				
B-7	0-1'	X				
B-7	1-3'	X	X		X	X
B-7	3-6'	X				
B-7	6-11'	X		X		
B-8	0-1'	X				
B-8	1-3'	X				
B-8	3-6'	X				
B-8	6-11'	X				
B-9	0-1'	X	X			
B-9	1-3'	X		X		
B-9	3-6'	X			X	X
B-9	6-11'	X				
B-10	0-1'	X				
B-10	1-3'	X			X	X
B-10	3-6'	X		X		
B-10	6-11'	X				
B-11	0-1'	X				
B-11	1-3'	X	X			
B-11	3-6'	X			X	X
B-11	6-11'	X		X		

On March 23, 2016, GEC advanced borings in the northwest section of the courtyard. GEC utilized a hand-held GeoProbe to advance an additional two borings B-12 and B-13. GEC collected samples from both of these borings at the following depth intervals: 0-1 feet, 1-3 feet, 0-3 feet and 3-6 feet. The samples collected from the 0-1, 1-3 and 3-6 foot intervals were analyzed for PCBs via USEPA Method 8082 with Soxhlet extraction. The samples collected from the 0-3 and 3-6 foot intervals were analyzed for EPH with PAHs via MassDEP's method, and for arsenic, lead and vanadium via USEPA Method 6010C.

For the B-11 0-1 foot interval soil sample, 100 mg/kg PCBs were detected. All other soil samples collected from B-5 to B-13 contained less than 50 mg/kg PCBs, and usually much less than 50 mg/kg PCBs. B-11 was identified as a potential hot spot of PCB-contaminated soils. Therefore, additional investigation was conducted to determine the extent of elevated PCBs near B-11.

On March 29, 2016, GEC collected additional soil samples in the vicinity of B-11 to delineate the area containing the highest detected level of PCBs in soils (i.e., 100 mg/kg in the 0-1 foot interval sample of B-11). GEC laid out a 5-foot radius and collected three samples from this radius (B-11-r5A, B-11-r5B and B-11r5C), in the following horizons: (1) for PCB analysis via USEPA Method 8082 with Soxhlet extraction – 0-1 and 1-3 foot intervals; and (2) for EPH and PAH analysis via MassDEP's method and vanadium analysis via USEPA Method 6010 – 0-3 foot interval. GEC also attempted to collect two samples from the ten-foot radius at locations designated B-11-10rA and B-11-10rB. B-11-10rA (located near a tin shed) was attempted three times; due to the presence of concrete on the courtyard, GEC was unable to collect a sample. B-11-10rB was collected from the same horizons and for the same analyses as the 5-foot radius sampling locations. All samples collected were submitted to Con-Test under chain of custody.

The soil analytical data are summarized in Table 1 for all OHM except PCB congener data. PCB congener data are summarized in Table 6.1. Sampling locations are depicted in Figure 4. The distributions of PCBs and vanadium in soils are depicted in Figures 6 and 7, respectively.

The April 2016 IRA Plan Modification proposed the following IRA activities: (1) removal of debris and structures from the courtyard to allow access to the courtyard soils; (2) the preparation of the utility void and coal chute as soil repositories; (3) the excavation of 0-1 foot interval soils for proper disposition; (4) the excavation of 1-3 foot interval soils for proper disposition; (5) the transport of key volumes of soils (i.e., SP-1 stockpiled soils and B-11 PCB hot spot soils) to a receiving facility approved to accept soils containing 50 mg/kg PCBs or more; (6) the transport of select volumes of soils to a receiving facility approved to accept less than 50 mg/kg PCBs and / or the placement of these soils into one or more on-Site soil repositories; (7) the construction of a protective barrier over the soils currently located more than 3 feet below grade; (8) continuation of the excavation of the petroleum-contaminated soils; and (9) if needed, creation of a soil repository within the former fuel oil bunker area, followed by completion of the excavation of PCB soils and placement into the final repository. The IRA remedial activities resumed on May 27, 2016.

<u>B-11 PCB Hot Spot Activities</u>

On May 27, 2016, the National Response Corporation (NRC) (ENPRO Services Inc. was acquired by NRC), under the oversight of GEC, excavated the >50 mg/kg PCB soil area around B-11 and B-11-r5-C). The area excavated was approximately 12 feet wide by 16 feet long by 1-1.5 feet deep. The approximately 10 cubic yards of soil excavated from this area were added to the 40 cubic yard SP-1 stockpile. Sidewall and bottom soil samples were collected for confirmatory PCB analysis via USEPA Method 8082. Three composite (5-point) samples were collected from the following locations: eastern sidewall, western sidewall and the bottom. Since the excavation extended to the Picker building to the south and the Boiler House to the north, there were no south or north sidewall samples. Refer to Figure 4A for sampling locations. The confirmatory PCB data are summarized in Table 1. The maximum concentration of PCBs detected was 1.1 mg/kg (in the west sidewall sample).

The >50 mg/kg PCB soils from the SP-1/B-11 stockpile were containerized on or about June 3 through 6, 2016, moved from the courtyard and placed in six roll-off dumpsters. The dumpsters were then shipped under six uniform hazardous waste manifests to a TSDF, Tradebe located at 410 Shattuck Way, Newington, NH, prior to shipment to Wayne Disposal

Inc., in Belleville, Michigan. One dumpster was shipped and received by Wayne Disposal Inc. on June 7, 2016, before MassDEP required asbestos analysis.

No asbestos was detected in the soil samples collected from the remaining five dumpsters (as described below in Asbestos Activities). Therefore, these five dumpsters were shipped from Tradebe to Wayne Disposal Inc. during late June 2016 and received by Wayne Disposal Inc. on July 11 and 12, 2016. A total of 74.08 tons of PCB-contaminated soils were shipped to Wayne Disposal Inc. for disposal. Refer to Appendix J for the completed uniform hazardous waste manifests.

Remaining Shallow Soil Courtyard Activities

After excavating the >50 mg/kg PCB area, GEC and NRC continued to execute the remainder of the modified IRA Plan. The top 1 foot of soils was excavated from the far west side of the courtyard, to prepare the area for stockpiling of soils excavated from the east end of the courtyard, overlying the fuel oil bunkers. A manhole cover was dislodged during this work and revealed a brick drywell. This drywell, designated dry well #1 on Figures 3, 5 and 5A, was designated a soil repository and was filled with soils from the west end of the courtyard.

Stockpile SP-2, comprised of the soils previously excavated from above the fuel oil bunkers, was placed within the "coal chute", which was prepared as a soil repository. The remainder of the space within the coal chute was filled with 0-1 foot interval soils excavated from the east end of the courtyard. The 0-1 foot interval soils from the east end of the courtyard were also placed in drywells #2, #3 and #4, depicted on Figures 3, 5 and 5A. A description of these repositories as well as the approximate volume of soils placed in each repository are provided in Section 3.3.

The top 0-1 foot interval soils were excavated from far west end of the courtyard, between the utility vault to the west and the B-11 PCB hot spot to the east, and from the east end of the courtyard, from the Boiler House smoke stack east to the retaining wall, separating the courtyard from the Concord River. Excavation of the top 1-3 feet of soil started at the east end of the courtyard, starting from east moving west. The work proceeded to about the west end of the fuel oil bunker to a depth of approximately 2.5 feet below grade, when the IRA was put on hold by the MassDEP based on concerns regarding the potential for asbestos being present in the courtyard soils.

The soils excavated from the east end of the courtyard, which were not placed in a soil repository, were stockpiled on the west end of the courtyard, near the utility vault between the Picker building and the Boiler House. This 300-400 cubic yard stockpile was placed directly on the exposed 1-3 foot interval soils because these soils are also slated for future excavation. The stockpiled soils are covered with polyethylene sheeting. Refer to Figure 5 for a depiction of the areas excavated and the location of the stockpiled soils. Figure 5A shows the location of each repository that is filled (i.e., coal chute and dry wells #1 to #4), as well as planned future repositories (i.e., utility vault and FO-1 & FO-2 excavation area).

Asbestos Activities

MassDEP required the six dumpsters of SP-1/B-11 soils containing the PCB soils be analyzed for asbestos. This request made after the dumpsters were shipped from the Site. On June 21, 2016, Axiom intercepted five of the six dumpsters at Tradebe and collected one composite sample from each of these dumpsters; no asbestos was detected.

The MassDEP also required that the courtyard soils be analyzed for asbestos. On June 23, 2016, Axiom collected nine composite soil samples throughout the courtyard for the presence of asbestos. The composite soil samples were collected from the existing stockpile (Hi, Mid and Low) and from six areas of the courtyard (Areas 1 to 6), as depicted in Figure 9. Each composite soil sample is comprised of five 1-inch soil samples. Eight soil samples were positive for the presence of chrysotile, and one was positive for the presence of amosite. No quantitative data was available for these samples. Refer to Table 7 for a summary of the asbestos analytical data.

Due to the presence of asbestos in soils, MassDEP Bureau of Air and Waste and MassDEP Bureau of Waste Site Clean-up required the following before IRA activities can resume: (1) covering the soils of the courtyard with polyethylene overlain with plywood; and (2) submittal of a Non-Traditional Asbestos Work Plan (NT) and another IRA Plan Modification to include the asbestos contaminated soils.

Non-IRA Related Activities

The following asbestos-related activities were conducted following the temporary stoppage of the IRA: (1) installation of a temporary gravel road, over the polyethylene sheeting, on a portion of the courtyard, so that asbestos abatement activities could be conducted; (2) installation of plywood "windows" in the Boiler house to mitigate potential future asbestos releases into the courtyard; (3) abatement of an asbestos-wrapped pipe located on a wall in the courtyard; and (4) removal of brick from the bottom of the Picker building smoke stack prior to demolition of the smoke stack.

In addition, the debris and abandoned pipes in the utility vault were removed, including a pipe wrapped with suspect asbestos containing insulation. GEC was told that, based on analytical testing, the insulation was comprised of fiberglass, not asbestos. A single active sewer pipe remains in the utility vault.

4.2.3 August 11, 2016 to October 28, 2016

Provided below is a description of the IRA assessment activities conducted since the IRA Status Report no. 3 for RTN 3-33101 was submitted on August 15, 2016. Additional assessment activities were conducted during September 2016, for the following purposes: (1) to obtain *in situ* disposal criteria data for the petroleum-contaminated soils so that a receiving facility can be identified such that petroleum-contaminated soils can be live-loaded for disposal; (2) to determine whether the petroleum-contaminated soils are also contaminated with asbestos and PCBs; (3) to determine the horizontal and vertical extent of petroleum-contaminated soils, so that the petroleum contamination can be added to the Phase III Remedial Action Plan; and (4) to obtain additional PCB analytical data requested by the U.S. USEPA Region I, so that a determination can be made whether all or a portion of the remaining remedial activities to be conducted within the courtyard fall under the U.S. Toxic Substances and Control Act (TSCA).

On September 15 and 16, 2016, Crawford Drilling Services, LLC (CDS) of Westminster, Massachusetts, advanced sixteen test borings (designated B-14, B-14A, B-15 to B-28), under the oversight of GEC, using a GeoProbe 7822 DT track rig, to depths up to 21 feet below current grade (or 23.5 feet below grade prior to removing three feet of soils from this portion of the courtyard during the earlier stage of the IRA). The initial intent was to advance the borings to 25 feet below current grade; however, refusal was encountered at depths ranging from 7 to 21 feet below current grade (i.e., 10 to 23.5 feet below original grade). Soils were recovered in 5-foot intervals using clean acetate sleeves. Soil recoveries were headspace screened with a MiniRAE 3000 PID equipped with a 10.6 eV lamp (10.6 eV PID). Soil samples were collected for analysis of EPH and PAHs via MassDEP's method, PCBs via USEPA Method 8082 with Soxhlet extraction, asbestos via USEPA Method 600/R-93/116, and disposal criteria testing, as identified in the table below. Soil samples were submitted to Con-Test, under chain-of-custody documentation, for analysis. Refer to Appendix A for the boring logs and Appendix B for the laboratory reports. Refer to Figure 4 for the new boring locations and to Table 1 for a summary of courtyard soil analytical data (except for the PCB congener analytical data, disposal criteria analytical data and asbestos analytical data), Table 4 for disposal criteria analytical data and Table 7 for asbestos analytical data.

Boring	Depth Interval (feet)	PCBs with Soxhlet	EPH and PAHs	Asbestos
B-14 **[A]	0-5			
	5-10			
	10-15***			
	15-16.5			
B-15 **[A]	0-5	X		
	5-10	Hold, then Activated	X	X
B-16 **[A]	0-5	X		
	5-10	Hold		X

	10-15	Hold	X	
B-17 **A	0-5	Hold		
	5-7.5	Hold	X	X
B-18 **A	0-5	X		
	5-10	Hold, then Activated	Hold, then X****	
	10-15	Hold, then Activated	X	
B-19 **A	0-5	X		
	5-10	Hold, then Activated	Hold, then X****	X
	10-15	Hold, then Activated	Hold, then X****	
	15-17		X	
B-20 **A	0-5	X		
	5-8	Hold	X	
B-21 **A	0-5*	X	X	X
	5-10*	X	X	X
	10-13.5*	X	X	X
B-22 **B	0-5		Hold	
	5-10		Hold	
	10-15		X	
	15-20		X	
B-23 **B	0-5		Hold	
	5-9		X	
B-24 **A	0-5*			
	5-8*			
B-25 **A	0-5*			
	5-7.5*			
B-14A **A	0-5	X	X	X
	5-10	X	X	X
	10-15***	X	X	X
	15-16.5	X	X	X
B-26 **A	0-5*			
	5-10*			
	10-13*, ***			
B-27 **A	0-5*			
	5-10*, ***			
	10-11*			
B-28 **A	0-5*			
	5-10*			
	10-15*, ***			
	15-18*			

* Sample recoveries collected from this boring had visible or olfactory evidence of petroleum contamination. All or a portion of this sample recovery was retained, mixed with other soils collected for disposal criteria testing, and four composite samples were created for disposal criteria testing. The composite soil samples were submitted to Con-Test for disposal criteria analysis, as follows: TPH via USEPA Method 8100M, SVOCs via USEPA Method 8270, PCBs via USEPA Method 8082 with Soxhlet extraction, pesticides via USEPA Method 8081, herbicides via USEPA Method 8151, MA14 metals via USEPA Method 6010, reactive sulfide via USEPA Method 9030A, reactive cyanide via USEPA Method 9014, specific conductance via Method SM 2510B, pH via USEPA Method 9045C, ignitability via USEPA Method 1030, and asbestos via USEPA Method 600/R-93/116.

**A Feet below current grade. Original grade was three feet higher, and was lowered during excavation activities during June 2016.

**[B] Feet below current grade. Original grade was one foot higher, and was lowered during excavation activities during June 2016.

***This soil sample was submitted for analysis of VOCs via USEPA Method 8260, as part of disposal criteria testing.

****This sample was held pending other EPH and PAH analytical results. Analysis was activated and conducted, with extraction occurring on day 29 (more than 2-fold the MassDEP's CAM (Compendium of Analytical Methods) 14-day limit for extraction for this analysis). As a result, the EPH and PAH data for this sample meets the CAM criterion for gross failure. This data was only used to define the distribution of petroleum-related contamination.

Urban fill, consisting of sands, silt, pebbles, gravel, pulverized rock, coal dust, ash, slag, roots, glass, brick and concrete, was encountered from ground surface to 16 feet and more below current grade (18.5 feet and more below original grade). Below the urban fill was unconsolidated material typically associated with a river bed (i.e., uniform fine, medium, coarse sands with trace pebbles and trace rounded stone). Often tight fine sands or pulverized rock were encountered at boring refusal.

Based on visual and olfactory evidence during test boring, petroleum contamination was observed in borings B-14, B-14A, B-21, B-22, B-25, B-26, B-27 and B-28, which (except for B-22) are located south of the former no. 6 fuel oil bunker FO-1. B-22 is located west of the pump house and fuel oil bunkers.

At B-14, evidence of petroleum contamination was encountered from approximately 2.5 feet to nearly the bottom of the boring, i.e., 16.5 feet below current grade (or 19 feet below original grade), within urban fill. The evidence of petroleum contamination consisted of oil smears along the wall of the sample sleeve, starting at approximately 2.5 feet below current grade; saturated urban fill starting at approximately 5-10 feet below current grade; and a petroleum odor at 10-15 feet current below grade, with a headspace screening of 7.4 ppmv. The fill layer ended at 16.5 feet current below grade (or 19 feet below original grade), below which were tight fine sands or pulverized rock. No visible evidence of petroleum contamination was encountered in the very fine sands / pulverized rock. Refusal was encountered at 17 feet below current grade.

At B-14A, evidence of petroleum contamination was encountered from approximately 2.25-15.5 feet below current grade (4.75-18 feet below original grade). The evidence of petroleum contamination consisted of oil-saturated urban fill. The fill layer ended at approximately 15.5 feet current below grade (or 18 feet below original grade), below which were tight fine sands. No visible evidence of petroleum contamination was encountered in the very fine sands. Refusal was encountered at 16.5 feet below current grade.

At B-21, a petroleum smearing and odor were observed at approximately 8-9 feet below current grade (10.5-11.5 feet below original grade), and a petroleum odor was observed at approximately 10-12 feet below current grade (12.5-14.5 feet below original grade), all within urban fill. Pulverized rock was observed below 12 feet. Refusal was encountered at 13 feet below current grade.

At B-22, a petroleum odor (more like gasoline than no. 6 fuel oil) was observed at the bottom of the urban fill layer at approximately 15-16 feet below current grade (16-17 feet below original grade). Soils beneath the fill appear consistent with river bed material (fine, medium, coarse sands, with trace amounts of pebbles and rounded stone. The boring was ended at 20 feet below current grade (21 feet below original grade).

At B-25, an oily smear was observed from approximately 2-5 feet below current grade (4.5-7.5 feet below original grade) and a sheen was observed from 5-6 feet below current grade (7.5-8.5 feet below original grade), all within the urban fill. Soils from 6-7.5 feet below current grade consist of pulverized stone with sand and silt. There is no evidence of petroleum contamination at 6-7.5 feet below current grade. The boring ended at 7.5 feet below current grade (10 feet below original grade).

At B-26, a petroleum sheen and petroleum contamination was observed from 3-13 feet below current grade (5.5-15.5 feet below original grade). At B-27, a petroleum odor was observed from 3-11 feet below current grade (5.5-13.5 feet below original grade). At B-28, petroleum was present from 15-18 feet below current grade (17.5-20.5 feet below original grade).

On September 30, 2016, four shallow borings were advanced five feet east, west, south and north of boring B-9, to determine if PCB levels exceeding 50 mg/kg were present in this area. A shovel was used to remove the gravel from over each boring point, then a hole was placed through the polyethylene sheet. A hand-held GeoProbe was used to advance each boring to between one and three feet below grade. The 0-1 foot-interval soil samples collected from each boring and the 1-3 foot-interval soil sample was collected from the B-9 (5' E) boring. These samples were submitted under chain of custody to Con-Test for analysis of PCBs via USEPA Method 8082A. The PCB analytical data are summarized in Table 1.

4.3 Interpretation of Analytical Results

The analytical data are interpreted relative to existing conditions and current grade, for PCBs, vanadium, petroleum hydrocarbons and asbestos. The existing grade level is the same as when IRA activities were stopped in June 2016.

<u>PCB</u>

The horizontal and vertical distribution of PCBs is depicted in Figure 6 and the analytical data is tabulated in Table 1. Based on an evaluation of the dioxin-like congener data for the PCBs, the PCBs are comprised of approximately 11% dioxin-like congeners. All dioxin-like congeners had a toxicity equivalence factor of 3E-05 relative to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Refer to Tables 6.1 to 6.4 for summaries and evaluations of the dioxin-like data.

Prior to IRA excavation, PCBs were detected at the highest levels in the 0-1 foot soil samples (up to 100 mg/kg), followed by 1-3 foot (up to 25 mg/kg), 3-6 foot (up to 6.3 mg/kg) and 6-11 foot (up to 6.2 mg/kg (only one out of nine samples with more than 0.5 mg/kg PCBs at this interval)). Horizontally, PCBs were detected in soils across the entire courtyard, with the highest level at B-11, located near a tin shed housing a stairway to the above grade walkway connecting the Boiler House and Picker building. A small hot spot of PCBs was detected in this area, comprised of the 0-1 foot interval at B-11 and B-11-r5C. Stockpile SP-1, which was comprised of soils from window wells and scrapings of surficial soils of the courtyard, contained 63 mg/kg PCBs. Out of thirteen 0-1 foot interval soil samples, eight contained PCBs at levels exceeding 10 mg/kg. These sampling points were spread throughout the courtyard. For the 1-3 foot interval, the highest PCB level was detected at B-13, located on the far northwest corner of the courtyard. Two out of thirteen soil samples from this interval contained PCB levels exceeding 10 mg/kg. They were located at opposite ends of the courtyard. For the 3-6 foot interval, the maximum PCB concentration was detected in one of the sidewall samples collected during removal of the gasoline USTs. For the 6-11 foot interval, the maximum PCB concentration was detected at B-11 (beneath the 0-1 foot PCB hot spot).

During the period March through September 2016 (including before and after excavation), seventy-nine discrete soil samples and six composite soil samples were analyzed for Aroclor PCBs, and four discrete soil samples were analyzed for congener PCBs. Only three samples (stockpile SP-1, 0-1 foot interval of boring B-11 (100 mg/kg), and the 0-1 foot interval soil sample collected five feet south of B-11 (97 mg/kg)) out of these 89 samples contained PCB levels higher than 50 mg/kg. The 0-1 foot interval soils in the vicinity of B-11 were excavated and the combined SP-1 / B-11 soils were transported off-Site to a hazardous waste facility approved to accept wastes containing >50 mg/kg PCBs. Confirmatory soil samples collected at the sidewalls and bottom of the B-11 excavation indicated a maximum PCB concentration of 1.1 mg/kg.

The 0-1 foot interval soil sample from boring B-9 contained 42 mg/kg PCBs, while the 1-3 and 3-6 foot interval samples contained 1.1 mg/kg PCBs and none detected, respectively. USEPA Region I requested that soil sampling be conducted around B-9 to determine if any of the soils contain more than 50 mg/kg PCBs. Four shallow soil borings were advanced, one each five-feet east, west, north and south of B-9. The 0-1 foot interval soil samples collected from these shallow borings contained between 9.1 and 36.5 mg/kg PCBs. The 1-3 foot interval soil sample from the east boring contained 15.2 mg/kg PCBs. This new analytical data indicates that PCB concentrations in soils are less than 50 mg/kg in the B-9 area.

The 0-1 foot interval soils were excavated from the Boiler House smoke stack east to the retaining wall along the Concord River and also from the west end of the courtyard from the utility vault west to the former B-11 PCB hotspot. These soils were placed in soil repositories (i.e., coal chute and four drywells) and a portion of which is located in the soil stockpile at the west end of the courtyard. At the east end of the courtyard, a portion of the 1-3 foot interval soils (approximately 1-2.5 foot interval soils) were excavated near the FO-1 fuel oil bunker east to the retaining wall. These were placed in the stockpile at the west end of the courtyard. These areas were excavated in June 2016 prior to the IRA stoppage.

During September 2016, additional test borings were advanced in the east portion of the courtyard, in part to determine if the PCB contamination is commingled with the shallower petroleum contamination. Fifteen soil samples, mostly collected at five-foot intervals, were collected from five test borings (B-14A, B-15, B-18, B-19 and B-21) advanced in this area for analysis of PCBs. For the 0-5 foot interval soil samples, PCB levels ranged between none detected to 29 mg/kg. For the 5-10 foot interval soil samples, PCB levels ranged up to 2.1 mg/kg. Below 10 feet, the PCB levels ranged up to 0.14 mg/kg. The new sampling locations are shown on Figure 4A.

The horizontal and vertical distribution of the PCB contamination for the entire courtyard is depicted on Figure 6. This figure reflects the current grade; therefore, for the eastern and western ends of the courtyard, the sampling intervals were adjusted for those samples collected prior to June 2016 to reflect current grade. Figure 6 and Table 1 also indicates what data is representative of those soils that were excavated, then transported off-site to a hazardous waste facility, moved to a repository or to the existing stockpile. For the portion of the east end of the courtyard, where the 1-3 foot interval soils were started but advanced only to about 2.5 feet before the IRA was stopped, Figure 6 and Table 1 reflects the removal of all 1-3 foot interval soils although some of these soils remain to be excavated.

Vanadium

The horizontal and vertical distribution of vanadium is depicted in Figure 7 and the analytical data is tabulated in Table 1. The sampling intervals for both Figure 7 and Table 1 are adjusted to reflect current grade. The key metal contaminant in terms of magnitude of detection and distribution across the courtyard is vanadium. It is a common constituent of coal, and its presence in the soils of the courtyard is likely attributable to the long-term use of coal to fire the boiler in the Boiler House and the coal ash found throughout the fill land of the courtyard. A derelict coal chute is still located in the courtyard. The soils of the courtyard contain a large proportion of coal and coal ash, especially for the original 0-3 foot interval. In some areas, the soils contain more coal ash than sands, silts or clay. For the original 0-3 foot interval, vanadium was detected at levels up to 2,100 mg/kg, and, in SP-1, the detected level of vanadium was 3,500 mg/kg. For the original 0-3 foot interval, the maximum level was detected at B-10, located near the coal chute. For the original 3-6 foot interval, the maximum vanadium level was 900 mg/kg, and for the original 6-11 foot interval, the maximum vanadium level was 870 mg/kg. For these intervals, the maximum concentrations were detected at B-11. No new vanadium data was collected for discrete soil samples during the September 2016 assessment round.

Petroleum

The horizontal and vertical distribution of petroleum is depicted in Figure 8 (based on total EPH and TPH analytical data) and 8A (based on visual and olfactory evidence). The analytical data is tabulated in Table 1. The sampling intervals for these figures and Table 1 were adjusted to reflect the current grade.

The highest levels of petroleum contamination were detected beneath and in the immediate vicinity of the FO-1 fuel oil bunker. A soil sample collected immediately below the presumed bottom of the FO-1 fuel oil bunker contained 33,000 mg/kg TPH. At B-14A, located immediately south of the FO-1 fuel oil bunker, soils were saturated with fuel oil from ground surface to the bottom of the boring 16.5 feet below current grade (historically 19.5 feet below grade). The maximum concentration of total EPH (34,300 mg/kg) was detected in the 10-15 foot interval sample from B-14A. Boring B-21, located near the southwest corner of the FO-1 fuel oil bunker, contained 598, 4,460 and 1,750 mg/kg total EPH at 0-5, 5-10 and 10-13.5 feet (historically 3-8, 8-13 and 14-16.5 feet), respectively. The total EPH concentration declined to 2,240 mg/kg in the 15-16.5 foot interval sample from B-14A. Borings B-24 to B-28 were also advanced along the south side of the FO-1 fuel oil bunker, in order from west to east. B-24, located on the west end, was advanced to 8 feet below grade; the recoveries from B-24 had no visible or olfactory evidence of petroleum contamination. B-25 to B-27 had visible and / or olfactory evidence of petroleum contamination from near or slightly below current grade to the bottom of the borings (7.5 to 13 feet below grade). B-28 at the east end on the south side had saturated oil from 10 feet to the bottom of the boring (17 feet below grade).

B-1, B-4 and B-20 are located further south of the FO-1 fuel oil bunker. B-1 contained 5,910 mg/kg total EPH in the sample collected 12-17 feet below current grade (15-20 feet below historic grade). B-4 contained 5,370 mg/kg total EPH in the sample collected 12-17 feet below current grade (15-20 feet below historic grade). B-20 contained 99 mg/kg total EPH in the sample collected 5-8 feet below current grade. These three borings were advanced to 17, 22 and 8 feet below current grade, respectively. Visible evidence of contamination was encountered at 16 feet (staining) in B-1 and at 14.5 feet (sheen) in B-4. B-3 was advanced to

24 feet below current grade (25 feet below historic grade). A sheen was encountered at 16.5 feet below current grade; however, the sample collected from the current 14-19 foot interval contained only 325 mg/kg total EPH.

Immediately north of the fuel oil bunker, soils from the 5-10 foot interval of B-15 contained 8,540 mg/kg total EPH. The B-15 foot boring reached refusal at 10 feet below grade; therefore, the vertical extent of contamination could not be determined at this location. B-15, B-17 and B-5 are located along the north side of the FO-1 fuel oil bunker. There was little to no visible, olfactory or detected evidence of petroleum contamination in the 0-5 foot interval soils. Evidence of contamination began at about 5 feet below grade and extended to the bottom of each boring, which ended at a maximum depth of 10 feet below current grade.

Boring B-16 is located immediately east of the FO-1 fuel oil bunker. This boring extended to 14 feet below grade. A petroleum odor was observed at 14 feet below grade, and total EPH was 1,380 mg/kg in the 10-14 foot interval sample. Borings B-18 and B-19 are located further east near the retaining wall separating the courtyard from the Concord River. These two borings were advanced to 14 and 17 feet below grade, respectively. In the 5-10 foot interval samples, the total EPH levels were 151 and 310 mg/kg, respectively, in these two borings. In the 10-15 foot interval samples, the total EPH levels were 899 and 1,050 mg/kg, respectively. The total EPH levels in the top 15 feet (based on current grade) are too low to suggest the potential presence of significant NAPL. The 15-17 foot interval sample from B-19 contained 2,538 mg/kg total EPH. This data suggests that near the retaining wall, the significant petroleum contamination is located more than 15 feet below current grade (18 feet below historic grade). In August 2015, depth to groundwater was measured in monitoring wells GEC-2 and GEC-3 at 19.87 and 22.70 feet below grade, which would correspond to 16.87 and 19.70 feet below current grade at the east end of the courtyard. The depth to groundwater could not be measured in monitoring well GEC-1 at that time due to the presence of a viscous NAPL. The depth to groundwater is consistent with the depth at which significant petroleum contamination is encountered away from the FO-1 fuel oil vault. The petroleum contamination is likely present as a smear zone straddling the water table.

Boring B-22, located west of the FO-1 fuel oil bunker, contained 953 mg/kg and none detected total EPH at 10-15 and 15-20 feet below grade (historically 11-16 and 16-21 feet below grade), respectively.

The results of the cumulative investigations indicate that immediately south of the FO-1 fuel oil vault, significant petroleum contamination extends from near current ground surface to depths likely spanning the water table. North of FO-1 fuel oil vault, the petroleum contamination extends from approximately 5 feet below grade to depths likely spanning the water table. Significant petroleum contamination does not appear to be located west of the FO-

1 fuel oil bunker. East and further south of the FO-1 fuel oil bunker, the petroleum contamination appears located near, and likely spans, the water table.

Figure 8B depicts the locations at and depths below which significant petroleum contamination has been detected or observed. Near the fuel oil bunker, the significant petroleum-contaminated soils are located 2 to 5 feet or more below grade. Further from the bunker, as a conservative measure, all soils below 10 feet are presumed to contain significant petroleum contamination because it has been observed or detected in some soil samples at 1t feet. However, in this area, most of the petroleum contamination starts at a smear zone that straddles the water table, located at or more than 17 feet below grade.

Commingling of PCB and Petroleum Contamination

USEPA Region I requested that a sample of the non-aqueous phase liquid (NAPL) be collected and analyzed for PCBs to determine if the no. 6 fuel oil and PCB contamination are commingled. There was a plan, during the September 2016 sampling round, to install one or more monitoring wells, if groundwater was encountered. No groundwater was encountered; therefore, no NAPL could be collected for analysis of PCBs. As an alternative method of evaluation, the levels of petroleum contamination and PCBs in soils were evaluated to determine to what extent the no. 6 fuel oil and PCB contamination are commingled. Petroleum-contaminated soils were collected for analysis of both PCBs and either TPH or EPH. The PCB levels in soil samples containing more than 2,000 mg/kg TPH or total EPH were evaluated to determine to what extent the PCB and petroleum contamination is commingled. This evaluation, documented in the table below, indicates that there is a low level, but not significant, commingling of PCB and petroleum contamination.

Boring	Depth (feet)*	Total EPH (mg/kg)	TPH (mg/kg)	PCBs (mg/kg)
FO-1	4-5		33,000	0.45
B-4	12-17	5,370		Not tested
B-5	3-8	2,450		0.29
B-14A	0-5	13,000		<0.15
B-14A	5-10	5,900		0.14
B-14A	10-15	34,300		0.14
B-14A	15-16.5	2,240		<0.13
B-15	5-10	8,540		0.30
B-19	15-17	2,530		Not tested
B-21	5-10	4,460		0.75
Comp 1			3,200	0.26
Comp 2			3,100	1.3
Comp 3			2,100	0.17
Comp 4			2,100	0.34

*Depth below current grade (as of 10/1/2016)

Further evaluation is provided below based on areas where excavation of petroleum contaminated soils is planned. Significant petroleum contamination immediately north of the FO-1 fuel oil bunker is located from approximately 5 feet below current grade to depths likely spanning the water table. This area is represented by borings B-17 (no PCB data available), B-15 and B-5. In this area, the soils located more than 5 feet below grade contained PCB levels ranging from 0.29 to 0.12 mg/kg. The 0-5 foot interval soils contained between 3.8 and 12 mg/kg PCBs. The 0-5 foot interval soils would be excavated and stockpiled from the area north of the FO-1 fuel oil bunker, prior to excavating the petroleum-contaminated soils. The 0-5 foot interval soils will be re-used on-Site within a soil repository.

Significant petroleum contamination immediately south of the FO-1 fuel oil bunker is located from ground surface to depths likely spanning the water table. This area is represented by borings B-14, B-14A, B-21 and B-24 to B-28. No PCB data exists for B-14, B-24 to B-28. B-21 and B-24 are located on the west end of this area, and no visible or olfactory evidence of petroleum contamination was encountered until 9 feet below grade. The 0-5 foot interval soil sample from B-21 contained a relatively low level of total EPH contamination (i.e., 598 mg/kg). Significant petroleum contamination was encountered at 5-10 feet below grade in this area. The PCB level for the 0-5 foot interval sample from B-21 was 11 mg/kg. Below 5 feet, the PCB levels ranged from <0.11 to 0.75 mg/kg.

Visible or olfactory evidence of petroleum contamination was first encountered at 5 feet for B-14 and B-14A (product/sheen), at 2 feet (smearing) for B-25, at 3 feet (smearing) for B-26, and at 0 feet (odor) at B-27. At B-28, located at the southeast end of the FO-1 fuel oil vault, visible evidence of petroleum contamination was not encountered until the 10-15 foot interval (saturated with oil). At B-14A, significant petroleum contamination was detected in the 0-5 foot interval sample (total EPH was 13,000 mg/kg). Based on these findings, the petroleum-contaminated soils in the area between B-25 to B-27 will be excavated from ground surface to depths spanning the water table.

Four composite soil samples were created using soils from borings B-21, B-24, B-25, B-26, B-27 and B-28 for disposal criteria testing. The levels of TPH ranged between 2,100 and 3,200 mg/kg, and the levels of PCBs ranged between 0.17 and 1.3 mg/kg. These samples are intended to be representative of conditions of soils slated for excavation and off-site disposition.

For the areas removed from the FO-1 fuel oil vault to the east and south, the following borings are representative of current Site conditions: (1) east: B-16, B-18 and B-19; and (2) south: B-1, B-4 and B-20. PCB data does not exist for B-28, B-1 or B-4. East and north of the FO-1 fuel oil bunker, the maximum PCB levels for the 0-5 foot interval were 29 and <0.11 mg/kg, respectively. For the 5-10 foot interval east of the FO-1 fuel oil bunker, the maximum

PCB level was 2.1 mg/kg. Below 10 feet east of the FO-1 fuel oil bunker, the maximum PCB level was <0.11 mg/kg. East and south of the FO-1 fuel oil bunker, significant PCB contamination does not extend below 5 feet; however, petroleum contamination is not encountered until near the smear zone straddling the water table. The 0-5 foot interval soils from this area will be stockpiled separately from the soils excavated from 5 to the smear zone. The 0-5 foot interval soils will be placed in an on-site soil repository.

The PCB and petroleum analytical data are summarized in Table 1. The disposal criteria data are summarized in Table 4. The distribution of PCBs in soils, based on current grade, is depicted in Figure 6. The distributions of TPH/total EPH and visible/olfactory evidence of petroleum contamination in soils, based on current grade, are depicted in Figures 8 and 8A, respectively.

Asbestos

All asbestos data was obtained after IRA activities were stopped in June 2016, and were collected at depth intervals reflecting current grade. The distribution of asbestos is depicted in Figure 9 and the analytical data is tabulated in Table 7.

Axiom submitted nine 0-1 inch composite samples for analysis of asbestos. Three samples were collected from the stockpiled soils (currently located on the west side of the courtyard, and originated from the east side of the courtyard), and six samples from the *in situ* courtyard soils. Eight of the samples contained chrysotile asbestos, and one sample contained amosite asbestos. Two of the sampling locations (Areas 5 and 6) are located entirely within eastern portion of the courtyard where approximately 2.5 feet of soils were excavated prior to the stoppage of the IRA. It is unknown if the presence of asbestos in these soils is due to its presence throughout the PCB/metal/insecticide-contaminated soils or if cross-contamination occurred during the IRA excavation activities. The Axiom data did not include quantitative levels of asbestos.

During the September 2016 boring program, GEC collected soil samples for analysis of asbestos: (1) eleven discrete soil samples at depth intervals ranging between 0-5 feet and 15-16.5 feet; and (2) four composite samples created from soils recovered in borings with visible/olfactory evidence of petroleum contamination. The purpose of this investigation was to determine if the petroleum-contaminated soils planned for excavation and off-Site treatment, recycling or disposal contained asbestos.

Only one of the fifteen soil samples contained a measurable level of asbestos. The 0-5 foot interval soil sample from boring B-21 (located near the northwest corner of the petroleum-contaminated area) contained 2% chrysotile. This 0-5 foot interval soil sample did not contain a significant amount of petroleum-related contamination (i.e., 598 mg/kg total EPH, Figure 8,

Table 1). Significant petroleum contamination (4,460 mg/kg total EPH) was detected in the 5-10 foot interval soil sample from B-21, but no asbestos was detected.

Based on this data, the petroleum-contaminated soils do not contain asbestos and do no need to be treated as asbestos contaminated waste once excavated. Prior to excavating the petroleum-contaminated soils, the shallow asbestos-contaminated soils over this area should be excavated and asbestos sampling of the 0-1 inch interval conducted to verify sufficient removal of asbestos-contaminated soils.

4.4 Description of Conditions of Courtyard / New Information

Figure 5 shows the current conditions of the courtyard, in terms of areas excavated, existing location of the 300-400 cubic yard stockpile of excavated soils, and other key features, such as coal chute, utility vault, manholes, fuel oil bunker (FO-1) and former gasoline UST (GT-1 and GT-2) locations. There are four areas where excavation has occurred. Each is briefly described below:

1. B-11 PCB hot spot, where soils were excavated to 1.5 feet below grade. Following confirmatory sidewall and bottom sampling, part of this area was backfilled with surrounding soils to create a ramp (18 inches high at its highest end) to allow movement of soils from the east end of the courtyard to the stockpile at the west end of the courtyard.
2. At the west end of the courtyard, 1 foot of soils were excavated and placed in drywell #1. The stockpiled soils from the east end of the courtyard were placed immediately over the west end soils, because the PCB contaminant levels are comparable between the two locations.
3. At the east end of the courtyard, 1 foot of soils were excavated from the Boiler house smokestack to the retaining wall along the Concord River.
4. At the east end of the courtyard, an additional 1.5 feet of soils were excavated from the FO-1 fuel oil bunker to the retaining wall along the Concord River.

Seven soil repositories were identified for the courtyard, of which five have been used. Each of the soil repositories is described below. Figure 5A depicts the used and proposed soil repositories.

1. <u>Coal Chute</u>: The coal chute is located along the Boiler House exterior wall, within the courtyard. The chute is constructed of concrete blocks on three sides and, until recently, was open to the Boiler House basement on the fourth side. This wall was closed to prepare the coal chute for use as a soil repository. The coal chute's dimensions are 15 feet long by 10 feet wide by 10 feet deep, and would likely hold approximately 40 cubic yards from 3 feet below grade to the bottom of the chute. The coal chute also contained debris and metal remnants along the walls. These were removed to prepare the coal chute for use as a soil repository. These activities were conducted from inside the Boiler House basement. The capacity of the coal chute is approximately 60 cubic yards. The coal chute has been backfilled with soils from the SP-2 stockpile and some of the 0-1 foot soils from the east

end of the courtyard, to the top. If a landscaped area is to be placed over the coal chute, the walls of the coal chute will have to be knocked down to approximately 3 feet below grade prior to covering the coal chute. The coal chute was temporarily filled to the top to eliminate this void space during remediation activities; if the top three feet of the coal chute is knocked down, the top three feet of soils will have to be removed. These soils are presumed to contain asbestos, in addition to PCBs.

2. Dry Well #1: This dry well is circular and constructed of brick. It is approximately 14 feet deep with a diameter of 10 feet. It has a capacity of approximately 41 cubic yards. It is filled with 0-1 foot interval soils to its top. Like the coal chute, some of the soils may have to be removed, if the walls will be knocked down 3 feet, so that a landscaped area can be constructed over the manhole. These soils are presumed to contain asbestos, in addition to PCBs.

3. Dry Well #2: This dry well is constructed of brick and has dimensions of 11 feet deep by five feet wide by five feet long. It has a capacity of approximately 10 cubic yards. It is filled with 0-1 foot interval soils to its top. Like the coal chute, some of the soils may have to be removed, if the walls will be knocked down 3 feet, so that a landscaped area can be constructed over the manhole. These soils are presumed to contain asbestos, in addition to PCBs.

4. Dry Well #3: This dry well is constructed of brick and has dimensions of 8 feet by 8 feet by 6 feet. It has a capacity of approximately 14 cubic yards. It is filled with 0-1 foot interval soils to its top. Like the coal chute, some of the soils may have to be removed, if the walls will be knocked down 3 feet, so that a landscaped area can be constructed over the manhole. These soils are presumed to contain asbestos, in addition to PCBs.

5. Dry Well #4: This dry well is constructed of brick and has dimensions of 8 feet by 8 feet by 8 feet. It has a capacity of approximately 19 cubic yards. It is filled with 0-1 foot interval soils to its top. Like the coal chute, some of the soils may have to be removed, if the walls will be knocked down 3 feet, so that a landscaped area can be constructed over the manhole. These soils are presumed to contain asbestos, in addition to PCBs.

6. Utility Vault: The utility vault is located at the west end of the courtyard. The utility void has a trapezoid shape. It is approximately 5 feet wide at one end and 16 feet wide at the other end, with a length of approximately 60 feet and a depth of 14 feet. The vault has a capacity of approximately 250 cubic yards, from 3 to 14 feet below grade (presumes tops of walls of utility vault are lowered by three feet). However, a clean utility corridor will have to be created around the live sewer line approximately 4 feet wide, which will reduce the storage capacity to approximately 125 cubic yards. Again, the walls of the void would have to be knocked down to 3 feet below grade, if the planned landscaped area is to extend over this area. The utility vault currently does not contain any soils.

7. FO-1 Fuel Oil Bunker Excavation Area: The portion of the excavation of petroleum contaminated soils above the smear zone of the water table is estimated to be at least 60 feet long from east to west, 30 feet wide from north to south, and 15 feet deep (based on existing grade), with a capacity of approximately 1,000 cubic yards. The sidewalls and bottom of the repository will have to have a marker layer, comprised of a geotextile fabric or similar material. Additional excavation will have to be conducted across the water table, in areas south and east of the FO-1 fuel oil bunker. If petroleum contamination is only

present across the smear zone in these areas, these areas may not be used as part of the FO-1 Fuel Oil Bunker soil repository.

Both USEPA Region I and MassDEP had verbal requests for additional investigations or assessments. USEPA Region I requested the following to determine if additional remediation of the courtyard falls under the jurisdiction of TSCA:

1. Description and results of additional investigations conducted within the courtyard, in particular:
    a. Additional borings and soil sampling surrounding B-9 to determine if levels of PCBs are higher than 50 mg/kg in this area.
    b. Additional borings and soil sampling in the petroleum release area, to determine the vertical and horizontal extent of petroleum contamination and the extent to which the PCB contamination is commingled with the petroleum contamination.
2. The approximate cost to remove the existing stockpile of PCB-contaminated soils relative to the cost to re-use the soils on-Site.

The results of the requested investigations are described and interpreted in Sections 4.2 and 4.3, respectively. The appropriate off-site disposition of the soils is limited to a hazardous waste facility that can accept soils containing between 10 and <50 mg/kg PCBs, asbestos and petroleum contamination. ENPRO Services Inc. (ENPRO), who developed the cost estimates, identified Waste Management of Norridgewock, Maine as a potential receiving facility. Given the constraints in accessing the courtyard, it is necessary to first move them using a front end loader along a narrow corridor between the Picker Building and retaining wall along the Concord River before placing them in a roll-off dumpster. Given the presence of asbestos and PCBs decontamination, there are significant potential issues with worker safety and decontamination of the expanded work area and additional equipment. ENPRO assumed the soils could be shipped under a Bill of Lading rather than under Uniform Hazardous Waste Manifests.

For the on-Site re-use option, the soils would be placed in an isolated soil repository located within the utility vault and / or the fuel oil bunker location, following petroleum excavation. This option would require less time and a smaller work area, and would be a greener choice since energy costs are not needed to transport and treat the soils.

ENPRO's cost estimate for the on-Site re-use option is between $17,995 and $22,754. Their cost estimate for the off-site transportation and disposal is between $145,045 and $154,058. When costs associated with disposal criteria sampling and testing are added, the cost for off-site transportation and disposal is likely approximately $170,000. Neither cost estimate includes oversight by a Licensed Site Profession or his/her representative.

Given that the remedial goal for the courtyard is a Permanent Solution, remediation will have to include elimination of NAPL in the subsurface, which is a source of petroleum sheens on the Concord River during times of drought. Therefore, significant additional remedial costs will occur for the following purposes: (1) excavation of petroleum-contaminated soils to depths straddling the water table; (2) potentially pumping oily water from the excavation hole; (3) installation of recovery wells / interceptor trenches so that oil water can be pumped from the subsurface if excavation does not eliminate the NAPL; and (4) improvements to the retaining wall to mitigate the seepage of oils into the Concord River. These costs are apt to be substantial, and, alone, will not result in a Permanent Solution.

Additional excavation of shallow PCB- and asbestos-contaminated soils will need to be conducted so that a protective barrier can be installed over the contaminated soils. The costs associated with this additional excavation are not included herein.

Given the additional remedial costs that will be incurred in an attempt to achieve a Permanent Solution, the difference in costs (approximately $150,000) between on-Site re-use and off-Site transport and disposal are significant enough to justify the on-Site re-use of the stockpiled soils.

MassDEP requested the following information be provided in the IRA Plan Modification:

1. The MassDEP Air and Waste Program requested that all information used to support and describe the planned IRA remedial activities be presented in a single document. Therefore, this submittal contains the information necessary to support the planned IRA remedial activities and also provides a step by step description of the IRA remedial activities, including equipment to be used.

2. Initially MassDEP Bureau of Waste Clean-up requested a focused Phase III Remedial Action Plan (RAP), which GEC interpreted to address only the PCB/metal/insecticide contamination. MassDEP then requested that the focused Phase III RAP, which was submitted in the August 2016 IRA Plan Modification No. 2, be modified to include the petroleum contamination. Additional investigation of the petroleum release was necessary to have sufficient data for the Phase III RAP. These investigations are described and interpreted in Sections 4.2 and 4.3, respectively. The Phase III RAP is no longer "focused" but is considered a complete Phase III RAP. It is provided in Section 4.6 and Appendix O. The first IRA Plan Modification, submitted in April 2016, included a risk assessment to support the remedial decisions for the PCB/metal/insecticide-contaminated soils. The original risk assessment is described briefly in Section 4.5 and provided with minor modifications from the original in Appendix L. To support the Phase III RAP contained in Section 4.6, an updated risk assessment had to be conducted for the east portion of the courtyard to include the petroleum contamination. This new risk assessment is described briefly in Section 4.5 and provided in Appendix M.

4.5 Risk Assessments

The Conceptual Site Model describing the site conditions and the Data Usability & Representativeness Evaluation are provided in Appendix K. For this EPA Risk-Based Application, the Data Usability & Representativeness Evaluation focuses on the PCB analytical data used to support the risk assessments.

Original Risk Assessment (April 2016), Modified

The modification to the original risk assessment (April 2016) was conducted for 0-1, 1-3, 3-6 and 6-11 foot interval soils of the courtyard, but excluded the petroleum contamination, which was believed to be located deeper than 11 feet. The original risk assessment also evaluated the fuel oil vault sands (SP-3). The receptors were construction workers and residents, because the Picker building is being redeveloped for residential use and the courtyard, when remediation / renovation is completed, is intended for passive use by the future residents. Assumptions were made that the courtyard soils would be located under a protective barrier, except during a six-month construction project. During the construction project, residential exposure is presumed to occur seven days a week via dermal contact, incidental ingestion and inhalation of dusts for the six-month period.

Based on the results of the original risk assessment, a Significant Risk of harm was found to exist for both the resident and construction from exposure to the 0-1 foot soils and the SP-3 vault sands. A Significant Risk of harm also exists to the resident (and nearly to the construction worker) from exposure to 1-3 foot interval soils. Based on this finding, a decision was made that the 0-3 foot interval soils would have to be excavated and either: (1) placed in an on-Site isolate soil repository; or (2) transported off-site for disposal. If placed in an on-Site repository, these soils could not be excavated or disturbed in the future, except under the oversight of a Licensed Site Professional (LSP), under a Soil Management Plan, by persons 40-hour OSHA trained and under the oversight of a person permitted to remediate and monitor asbestos contamination, in accordance to the Massachusetts asbestos regulations. This finding did not consider that asbestos contamination is present in the shallow soils. No Significant Risk of harm was found to exist for the soils between 3 and 11 feet below grade, assuming that they remain covered with a protective barrier, which, since the courtyard is presumed to be renovated as a landscaped area, to consist of a marker barrier with three feet of clean fill. These findings are relative to the original grade of the courtyard, prior to the June 2016 excavations. Refer to Appendix L for this risk assessment.

East Portion of Courtyard Risk Assessment, including Petroleum Contamination (October 2016)

The risk assessment for the east portion of the courtyard was conducted based grade for the area from the Boiler house smokestack east to the retaining wall along the Concord

River. Separate risk assessments were conducted for the 0-3, 3-6 and 6-20 foot intervals, and included the petroleum contamination. The receptors were construction workers and residents, because the Picker building is being redeveloped for residential use and the courtyard, when remediation / renovation is completed, is intended for passive use by the future residents. Assumptions were made that the courtyard soils would be located under a protective barrier, except during a six-month construction project. During the construction project, residential exposure is presumed to occur three days a week via dermal contact and incidental ingestion and seven days per week via inhalation of dusts for the six-month period for the 0-3 and 3-6 foot intervals; and seven days a week via dermal contact, incidental ingestion and inhalation of dusts for the 6-20 foot interval soils.

Based on the results of this risk assessment, No Significant Risk of harm was found to exist for both the resident and construction from exposure to the 0-3, 3-6 and 6-20 foot interval soils. However, to reach a finding of No Significant Risk for the resident for the 0-3 and 3-6 foot intervals (but not the 6-20 foot interval), an assumption had to be made that the frequency of exposure to the resident would be limited during a construction project via specific provisions in the Soil Management Plan (such as fencing / barricading / containerizing excavated soils; covering soils with polyethylene sheeting; and/or posting warning signs prohibiting access). Based on this finding and due to the presence of asbestos in at least some of the soils, a decision was made that one or more of the following would have to be done for the 0-3 and 3-6 foot interval soils for the current grade: (1) place the soils more than three feet below grade under a protective barrier and increasing the provisions of the Notice of AUL to include the additional Soil Management Plan requirements; (2) place the soils in an on-Site isolate soil repository that will prohibit access except under the oversight of a Licensed Site Professional and Massachusetts-certified asbestos contractor; or (3) transporting the soils off-site for disposal at an approved hazardous waste facility. This finding considers that asbestos contamination is present in the shallow soils. No Significant Risk of harm was found to exist for the soils between 6 and 20 feet below grade, assuming that they remain covered with a protective barrier, which, since the courtyard is presumed to be renovated as a landscaped area, to consist of a marker barrier with three feet of clean fill. These findings are relative to the current grade of eastern portion of the courtyard, and only apply to the eastern portion of the courtyard. Refer to Appendix M for this risk assessment.

The petroleum contamination is generally higher at depth; however, because an assumption is made that these soils will remain below a protective barrier, they do not pose a Significant Risk of harm to human health. However, due to the presence of NAPL with macro-scale mobility (as evidenced by the seepage of NAPL to the Concord River), a Significant Risk of harm would exist for both the environment and public welfare.

Risk Assessment to Support the Application for Risk-Based Cleanup of PCBs (December 2016)

This risk assessment is modified from the original Site-specific Method 3 Risk Characterization, prepared in April 2016, to support the Immediate Response Action for RTN 3-33101, as modified in the IRA Plan Modification for RTN 3-33101, submitted on November 2, 2016. This risk assessment is modified to reflect the removal and off-site transport of the PCB hot spot soils and SP-1 stockpile soils; to evaluate the 0-3, 3-6 and 6-15 foot interval soils because the remediation of the 0-3 foot interval soils has already started. To support the planned and initiated (but put on hold) remediation that will continue under a combination of IRAs, RAM and EPA Risk-Based Approval, the risk estimates were re-calculated for the 0-3, 3-6 and 6-15 foot intervals based on original grade. The risk estimates were also re-calculated to include additional analytical data collected since April 2016. This risk assessment is provided in Appendix N.

Asbestos is present in shallow soils. This risk assessment does not address the risks associated with asbestos exposure. An assumption is made that all asbestos-contaminated soils will be excavated and either transported off-site for appropriate disposal or placed in an on-Site soil repository.

This risk assessment uses the default values provided in MassDEP's Risk Assessment Guidance, associated Technical Updates and MassDEP's risk assessment ShortForms. Further, some default values were modified to reflect the presence of a protective cover over the soils of the courtyard and the limited potential for exposure now or in the future. A comparison of MassDEP's default values to USEPA's default values is also provided in Appendix N, and demonstrates that the MCP risk assessment is at least as conservative as the USEPA's risk assessment in protecting public health.

This risk assessment focuses on potential exposure to future residents, represented by a child aged 1-2 years old. Risks associated with potential exposures to construction workers are adequately presented in the original risk assessment.

The prior risk assessment(s) already determined that the 0-1 and 1-3 foot interval soils would constitute a Significant Risk of harm, following even a short period of exposure. The remedial plan anticipates placing these soils in on-Site isolated soil repositories or transporting them off-site, if sufficient storage capacity is not available in the repositories. Therefore, the 0-1 and 1-3 foot interval soils were combined into one exposure interval (0-3 foot interval) for the purpose of this risk assessment. An assumption is made that human exposure to these soils will not occur in the future, because the repositories will remain undisturbed, except under restrictive conditions identified in a deed restriction (see Section 6.0 for more details).

No Significant Risk of harm was found to exist for the 3-6 and 6-15 foot interval soils during a future six-month construction project, presuming a protective barrier is maintained over these soils. In actuality, human exposure to these soils will not occur in the future, because the protective barrier will be periodically inspected and remain in place, as required by a deed restriction (see Section 6.0 for more details). Also, the soils beneath the protective barrier will remain undisturbed, except under restrictive conditions identified in a deed restriction (see Section 6.0 for more details).

This risk assessment also provides the documentation supporting the development of a risk-based PCB cleanup standard. The risk-based PCB cleanup standard for soils is derived to be 10 mg/kg total PCBs, as a 95th% upper confidence limit on the mean. A single soil sample maximum total PCB standard is 50 mg/kg. These PCB standards will apply to the additional investigations to be conducted at B-18, required by the USEPA Region I PCB Coordinator (see Section 5.3 for more details).

4.6 Phase III Remedial Action Plan / Feasibility Evaluation of PCB Alternatives

The revised Phase III RAP is also the Feasibility Evaluation of PCB Alternatives, and includes the soils contaminated with PCBs, asbestos, metals, insecticides and/or petroleum. It is provided in Appendix O. Based on the Phase III RAP / Feasibility Evaluation of PCB Alternatives, the selected remedies are the following:

1. Excavate the shallow asbestos- and PCB-contaminated soils (0-3 foot interval) from the courtyard such and placement of the soils in on-Site soil repositories, with transportation of any soils beyond capacity to an appropriate facility that can receive >10 to 50 mg/kg PCB-contaminated soils, asbestos-contaminated soils and/or petroleum-contaminated soils (as applicable to specific volumes of soils). Distinctive markers would have to be installed marking the top of each soil repository. Markers would also have to be installed to mark the sidewalls and bottom of the FO-1 fuel oil bunker excavation. The location and elevation of each soil repository would have to be surveyed by a Massachusetts registered surveyor. A clean utility corridor would have to be installed in the utility vault for the live sewer line, if the utility vault will be used as a soil repository.

2. Excavation of petroleum-contaminated soils and transport of the soils to an appropriate facility that can receive up to 10 mg/kg PCBs and petroleum-contaminated soils. Dewatering of the excavation may be needed to remove oily water and allow sufficient access to the petroleum-contaminated soils.

3. The application of a Gunite seal to the landside of the retaining wall, possibly followed by the installation of a cement/bentonite grout slurry wall along sections of the retaining wall, which are intended to contain the NAPL and preventing it from migrating to nearby surface water.

4. As a contingency in case the soil excavation is not sufficient to eliminate the NAPL and/or NAPL is still weeping from the retaining wall into the surface water, the installation of multiple oil recovery wells or an interception trench with recovery well, in case recoverable macro-scale or micro-scale NAPL. The appropriate method for NAPL recovery would be made in the field based on the location, depth and accessibility of the NAPL smear zone. No oil recovery pumps would be placed in the recovery wells at the time of installation. One or more recovery pumps would be installed only if NAPL is observed in one or more recovery wells and the NAPL is determined to be recoverable, based on NAPL transmissivity testing or other comparable testing method.

5. Installation of a marker barrier and protective barrier (such as three feet of clean soils) over the soils located more than 3 feet below final grade, and the installation of a clean utility corridor for the storm drainage system that is to be installed in the courtyard. The location of the clean utility corridor in the courtyard would have to be surveyed by a Massachusetts registered land surveyor.

4.7 Remediation Waste, Remedial Wastewater and Remedial Additives

To date, five stockpiles of soils are or were located in the courtyard. Stockpile SP-1 contained the soils and other solid debris created by the renovation General Contractor when soils and other debris were removed from the window wells and surface of the courtyard. This approximately 40-cubic yard stockpile was located in the east corner of the courtyard. Based on disposal criteria testing, these soils contain elevated levels of lead (2400 mg/kg), arsenic (23 mg/kg), vanadium (3500 mg/kg), zinc (1100 mg/kg), PCBs (63 mg/kg) and heptachlor epoxide (0.29 mg/kg). No TCLP lead, TCLP cadmium or TCLP heptachlor were detected above the applicable Resource Conservation and Recovery Act (RCRA) criteria. The disposal criteria data are summarized in Table 4. In late May 2016, approximately 10 cubic yards of soil were excavated from the B-11 PCB hot spot and added to the 40 cubic yard SP-1 stockpile. The soils of this combined stockpile were containerized and moved with difficulty through the Picker House building and placed in separate roll-off dumpsters so that they could be transported off-Site. The >50 mg/kg PCB soils from the SP-1/B-11 stockpile were containerized on or about June 3 through 6, 2016, moved from the courtyard and placed in six dumpsters. The dumpsters were then shipped under six uniform hazardous waste manifests to a TSDF, Tradebe located at 410 Shattuck Way, Newington, NH, prior to shipment to Wayne Disposal Inc., in Belleville, Michigan. One dumpster was shipped and received by Wayne Disposal Inc. on June 7, 2016, before MassDEP required asbestos analysis. No asbestos were detected in the soil samples collected from the remaining five dumpsters. Therefore, these five dumpsters were shipped from Tradebe to Wayne Disposal Inc. during late June 2016 and received by Wayne Disposal Inc. on July 11 and 12, 2016. A total of 74.08 tons of PCB-contaminated soils were shipped to Wayne Disposal Inc. for disposal. Refer to Appendix J for the completed uniform hazardous waste manifests.

Stockpile SP-2 contained the soils removed to access the FO-1 fuel oil bunker. In June 2016, this approximately 25-cubic yard stockpile was placed in the coal chute, which was modified to be an on-Site soil repository. No disposal criteria testing was done for these soils, because they are believed to be comparable to 0-3 foot interval soils elsewhere in the courtyard. Also, prior to excavation, these soils (FO-TP-1 (0-1'), FO-TP-1 (1-2') and FO-TP-1 (2-3')) were analyzed for PCBs, pesticides and herbicides, and were found to contain levels of lead (up to 1100 mg/kg), PCBs (up to 13 mg/kg) and dieldrin (0.19 mg/kg) consistent with other 0-1 and 1-3 foot interval soils throughout the courtyard. These data are summarized in Table 1.

The stockpile of petroleum contaminated soils (estimated at less than 10 cubic yards) was returned to the bottom of the FO-1 bunker excavation, when soil excavation was temporarily terminated in March 2016. Polyethylene sheeting was placed on top of the petroleum-contaminated soils, before backfilling with SP-3 soils, as described in the next paragraph.

Stockpile SP-3 contains the soils (sands) from the top portion of the FO-1 tank bunker. Based on disposal criteria testing, these soils contain elevated levels of thallium (9.8 mg/kg) and PCBs (2.6 mg/kg). The analytical data are summarized in Table 4. These soils (estimated to be 20 cubic yards) were returned to the FO-1 bunker (atop the polyethylene sheeting on the petroleum-contaminated soils) when soil excavation was temporarily terminated for the FO-1 bunker in March 2016.

In addition, the gasoline UST graves were lined with polyethylene sheeting and the soils from the gasoline UST excavation were placed on top of the polyethylene sheeting. Polyethylene sheeting was placed on top of these soils, and the tank grave was further backfilled using soils from the top of the no. 6 fuel oil bunkers (FO-1 and FO-2). The backfill in the tank graves is presumed to contain PCBs and metals.

On March 16, 2016, the two gasoline USTs were transported to Winfield Alloy Inc., of Lawrence, Massachusetts, for recycling. On March 28, 2016, the water (approximately 225 gallons) from the two USTs was shipped under a Uniform Hazardous Waste Manifest (UHWM) to Cyn Environmental Services, of Dover, New Hampshire, for treatment. The receipts for the USTs and the UHWM for the tank water are provided in Appendix J.

In June 2016, Soils from the 0-1 foot intervals at the east and west portions of the courtyard were excavated and placed in the following on-Site soil repositories: (1) dry wells #1, #2, #3 and #4, which have a current storage capacity of 41, 10, 14 and 19 cubic yards, respectively; and (2) the coal chute, which had an additional storage capacity of 35 cubic yards after the 25-cubic yards of SP-2 soils were placed in it. The total of soils placed in on-site soil repositories to date is approximately 144 cubic yards.

An additional 300 to 400 cubic yards of soil are currently located in the stockpile at the west end of the courtyard. These soils are lying directly on the dirt, because they contain the same contaminants at comparable levels, and are covered with polyethylene sheeting. These soils are slated for placement in on-site soil repositories, once IRA remediation is re-initiated.

No remedial additives were used during this IRA Status Report period.

5.0 PROPOSED RISK-BASED CLEANUP OF PCBS / RELEASE ABATEMENT MEASURE FOR RTN 3-33474 / IMMEDIATE RESPONSE ACTIONS FOR RTN 3-33101 AND RTN 3-33853

The EPA Risk-Based Application and RAM Plan for RTN 3-33474 are the same as the IRA Plan Modification for RTN 3-33101 and IRA Plan for RTN 3-33853, as presented in the conditionally-approved IRA Plan Modification. The RAM Plan for RTN 3-33474 and EPA Risk-Based Application are presented largely unchanged from the IRA Plan Modification, with the following exceptions: (1) the remedial activities of the IRA Plan for RTN 3-33793 are excluded from this RAM Plan; (2) as required by USEPA Region I, provisions are added for the collection and PCB analysis of soil samples surrounding boring B-18 (Section 5.3) and, if PCB levels exceed 50 mg/kg, the excavation and off-Site disposition of the PCB-contaminated soils surrounding B-18 (Sections 4.1 and 4.2); and (3) as required by MassDEP, the dust action level is reduced to a maximum of 150 $\mu g/m^3$ for all excavation work (Appendix P). The EPA Risk-Based Application is also modified by adding elements required for EPA approval of risk-based cleanup of PCBs under TSCA.

5.1 Objectives, Specific Plan and Proposed Schedule

The IRA remedial activities already conducted for RTN 3-33101 entail the following: (1) removal of the GT-1 and GT-2 gasoline USTs; (2) approximately 20 cubic yards of soils originating from the top of the fuel oil bunkers were temporarily placed on polyethylene sheeting overlying the petroleum-contaminated soils inside the FO-1 fuel oil bunker; (3) additional soils from the top of the fuel oil bunkers were placed on top of polyethylene sheeting inside the GT-1 and GT-2 tank graves; (4) excavation of approximately 10 cubic yards from the B-11 PCB hot spot (as depicted in Figures 4A and 5) and transport of it along with approximately 40 cubic yards of SP-1 stockpile soils to a hazardous waste facility approved to accept soils containing >50 mg/kg PCBs; (5) excavation of the 0-1 foot interval soils across the east end of the courtyard (as depicted in Figure 5); (6) placement of 0-1 foot interval soils into four dry wells and the coal chute, as depicted in Figure 5A; (7) excavation of 1 to approximately 2.5 foot interval soils from the east end of the courtyard (as depicted in Figure 5); and (8) placement of the remainder of the 0-1 foot interval soils and the 1-2.5 foot interval soils in an approximately 300-400 cubic yard stockpile located at the west end of the courtyard (as depicted in Figure 5). The stockpiled soil and courtyard soils are covered with 6-mil polyethylene sheeting, with plywood placed on top in some areas.

A small access road was created inside the courtyard to allow access of heavy machinery for asbestos-abatement related and demolition activities. The small access road was created within the courtyard, extending from the mouth of the corridor entering the courtyard on the northeast corner and extending to the Picker building shaft, which has been partially razed. This access road is constructed of 3 to 6 inches of clean processed sand and gravel placed directly on polyethylene sheeting. The access road is approximately 100 feet long and 8 to 10 feet wide, to allow access by heavy equipment and personnel during asbestos abatement and demolition activities. This access road will be dismantled during IRA remedial activities. The gravel will be stockpiled on and covered by 6-mil poly and will be re-used as part of the backfilling of the petroleum excavation and or for regrading prior to the placement of the marker barrier.

An existing masonry shaft (also called corridor) located along the east side of the Picker building has been converted into an access way for the courtyard. It is approximately 140 feet long and 10 feet wide, and is constructed of 6-mil polyethylene sheeting covered by 20-mil black polyethylene sheeting. A layer of ¾-inch plywood was placed on top of the polyethylene sheeting to protect it from tears and punctures, and another layer of 20-mil black polyethylene sheeting was placed on top of the plywood.

The planned remedial activities include the following: (1) creating of a clean utility corridor inside the utility vault and placement of stockpiled asbestos/PCB-contaminated soils into the repository portion of the utility vault; (2) excavation of surficial asbestos-contaminated soils from the eastern portions of the courtyard; (3) segregating the eastern asbestos-remediated portion of the Site from the remainder of the courtyard that has asbestos-contaminated soils; (4) excavation of visibly petroleum-contaminated soils from the eastern portion of the courtyard and transportation off-site for treatment or disposal; (5) excavate soils along portions of the retaining wall to its base and the application of a Gunite spray or the installation of a slurry wall and (optional) installation of a water interceptor pipe along the retaining wall and the installation of NAPL recovery wells; (6) backfilling this area with soils that were excavated but did not contain visible evidence of contamination; (7) creation of FO-1 soil repository; (8) placement of the stockpiled soils at the west end of the courtyard into the FO-1 soil repository; (9) excavation of the remaining 1-3 foot interval soils at the west end of the courtyard and placement in the FO-1 repository; (10) excavation of the 0-1 and 1-3 foot interval soils from the remainder of the central portion of the courtyard and placement in the FO-1 repository; (11) removal of the top three feet of soils in the dry wells and coal chute and placement of these soils in the FO-1 repository, so that the walls of the dry wells and coal chute can be lowered to three feet below final grade: (12) capping the dry wells and coal chute with concrete, and placement of distinctive marker barriers over the utility vault and FO-1 soil repository; (13) placement of another distinctive marker barrier over the remaining soils of the courtyard, which would be located three feet below final grade; (14) installation of a clean utility corridor along the south side of the courtyard, near the Picker building, to house the storm water system; (15) survey of the locations and elevations of the six soil repositories and the two clean utility corridors; and (16) backfilling of the courtyard to final grade, with three feet of clean fill. Each of these remedial tasks will be conducted in the sequence described in greater detail below.

All work will be conducted in accordance to Site-specific health and safety plans (HASPs) prepared by each contractor for its personnel. All work will be conducted in accordance to GEC's soil management plan, dust monitoring procedures, dust suppression procedures and decontamination procedures, provided in Appendix P. These plans and procedures have been prepared to reflect the presence of PCBs in soils. When excavation or movement of asbestos-contaminated soils is being conducted, the work will be conducted in accordance with Axiom's personnel protective equipment, air monitoring, decontamination, disposal and other asbestos-related procedures provided in Appendix P. For asbestos-contaminated soils, if there is a conflict between GEC's and Axiom's procedures, Axiom's procedures will be followed.

At all times except during specific tasks requiring their removal, all courtyard soils and stockpiled soils must remain covered with 6-mil polyethylene sheeting. Dust monitoring will be conducted continuously during work in the courtyard. Asbestos monitoring will be conducted continuously during work in the courtyard unless the Massachusetts-licensed asbestos project manager decides it is not warranted during a specific step of the remediation. Asbestos sampling locations are identified on Figure 10A. Two of these locations will also be used as dust monitoring locations. A three-stage personnel decontamination facility and equipment washing station will be located at the west end of the corridor away from the courtyard, as depicted in Figure 10A. The courtyard and corridor are considered exclusion zones.

Equipment that will be used during this project will include, at a minimum, the following:

(1) Excavator
(2) Front-end loader with front skid steers
(3) Water truck
(4) Compactor

(5) Pressure washer trailer
(6) Frac tanks
(7) Dewatering pump(s)
(8) Roll-off dumpsters, each lined with two form-fitted premanufactured bladder bags
(9) Dust monitors
(10) Asbestos air monitors
(11) Personal air monitors
(12) Personal protective equipment, including air-purifying respirators, Tyvek or equivalent suits, nitrile gloves, rubber boots and safety glasses
(13) Asbestos soil sampling materials / sample bags
(14) Remote, three chamber decontamination facility, equipped with tepid water, soap, disposable towels and other items necessary for containment and control of asbestos
(15) A decontamination center for equipment, which includes a HEPA vacuum, power washing equipment, and appropriate containers for asbestos-contaminated debris
(16) 6-mil polyethylene sheeting and ¾-inch plywood
(17) Three types of geotextile membranes having distinctive colors, for use in creating or marking soil repositories, clean utility corridors or covering the top of the courtyard soils that will be located three feet below final grade
(18) Orange snow fencing that will be used together with geotextile fabric to mark the sidewalls of the FO-1 soil repository, and that will be used to separate the asbestos cleared portion of the courtyard from that portion that still contains asbestos-contaminated soils
(19) Concrete to cap the top of the dry wells and coal chute soil repositories and/or for the slurry wall/Gunite spray
(20) Any other materials necessary to complete the project, provide adequate control of the asbestos, and protection of personnel

The IRA activities will be conducted in five major parts, identified as the following: (1) creation of a clean utility corridor inside a portion of the utility vault, and moving a portion of the stockpiled asbestos/PCB-contaminated soils into the remainder of the utility vault; (2) removal of asbestos-contaminated soils from the east side of the courtyard and separating the east and west sides of the courtyard to divide the area cleared of asbestos from the area with asbestos-contaminated soils; this approach will allow for excavation of petroleum-contaminated soils so that the FO-1 soil repository can be created to receive the asbestos/PCB-contaminated soils; (3) excavation of the petroleum-contaminated soils, creation of the FO-1 soil repository, installation of a Gunite spray or slurry wall followed by either a cutoff trench (if necessary), and installation of oil recovery wells; (4) movement of asbestos/PCB-contaminated soils from the existing stockpile to the FO-1 soil repository, and excavation of 1-3 foot interval and 0-3 foot interval soils from the west end and west central portions of the courtyard for placement in the FO-1 soil repository; and (5) installation of marker barriers and a protective cover, including installation of a clean utility corridor to house a storm water system. The proposed location of the storm water system is depicted in the plans in Appendix Q. Additional step-wise details on the planned IRA activities are described below and in Figures 10B to 10K.

Remediation Step	Figure	Description
Utility Vault	10B	1. The top of the walls of the utility vault will be knocked to three feet below grade. 2. A 4-foot wide clean utility corridor will be constructed around the live sewer line, inside the utility vault. This utility corridor will be constructed using wood or other hard material to support its sides and will be lined on its sides and bottom with geotextile membrane. Clean sands will be used to fill the utility corridor, or other procedure may be used if a hard cover will be placed on the utility vault. If the top of the vault will not be covered with a hard cover, a geotextile membrane will be placed on top of the clean utility corridor that is different than the one placed on top of the remainder of the utility vault. 3. Approximately 125 cubic yards of PCB/asbestos-contaminated soils from the existing stockpile and will be placed inside the soil repository part of the utility vault. 4. After the utility vault is filled to three feet from final grade, a distinctively colored geotextile fabric will be placed over the soil repository portion of the vault, the fabric will be overlain with 3 inches of gravel and temporarily covered with clean 6-mil polyethylene sheeting and ¾-inch plywood while the remainder of the courtyard is being remediated. 5. The location and elevation of the utility vault soil repository and clean utility corridor will be surveyed by a Massachusetts-registered surveyor; the location of the clean utility corridor will be eventually permanently marked in the courtyard so that it can be located.
Asbestos Soil Excavation A*	10C	1. Prior to conducting work in this area (except perhaps for moving stockpiles if needed provide access), additional soil sampling will be conducted at boring B-18, as described in Section 4.3. If any soil sample contains more than 50 mg/kg total PCBs, these soils will require excavation and transport off-Site to a facility approved to accept both asbestos-contaminated soils and soils containing >50 mg/kg PCBs. This excavation, with TSCA-grid confirmatory sampling, will be done prior to proceeding with steps 2 to 8. Excavation will continue until all soil samples contain no more than 50 mg/kg PCBs. If no soil samples contain >50 mg/kg PCBs, then soil excavation can continue as described in steps 2 to 8. An assumption is made that no more than 50 cubic yards of soils contaminated with >50 mg/kg PCBs will need to be transported off-Site. 2. The SP-3 soils located on polyethylene sheeting at the top of the FO-1 fuel oil bunker will be removed and placed on the existing stockpile on the west end of the property. These soils are presumed to contain both asbestos and PCBs, because they originated from the fill over the FO-1

		fuel oil bunker. 3. The backfill placed at the top of the GT-1 and GT-2 tank grave on polyethylene sheeting, also originated from the fill over the FO-1 fuel oil bunker. This soil will be excavated and placed on the existing stockpile at the west end of the courtyard. 4. The top one-foot of soils from the east end of the courtyard will be excavated and placed on the existing stockpile at the west end of the courtyard. 5. The Massachusetts-licensed asbestos manager will divide the east end of the courtyard into sections, and will collect five 0-1 inch soil samples from each section. For each section, these soil samples will be composited into a single sample, placed into a labeled container (e.g., Whirlpak™ sample bags), and submitted under chain of custody documentation to a Massachusetts-certified laboratory for analysis of asbestos via USEPA Method 600/R-93/116. 6. The soils of the east end will be covered with clean 6-mil polyethylene sheeting, pending the results of the asbestos analyses. 7. If asbestos is detected in any section of the east end of the courtyard, steps 3, 4 and 5 will be repeated for the affected section until no asbestos is detected. 8. Once the excavation of asbestos-contaminated soils is complete, these soils will remain covered with 6-mil polyethylene sheeting until excavation of petroleum contaminated soils is conducted. For more details see the Petroleum Soil Excavation Steps A and B.

Asbestos Soil Excavation B**	10D	1. The top one-foot of soils from the east central portion of the courtyard will be excavated and placed on the existing stockpile at the west end of the courtyard. 2. The Massachusetts-licensed asbestos manager will divide the east central portion of the courtyard into sections, and will collect five 0-1 inch soil samples from each section. For each section, these soil samples will be composited into a single sample, placed into a labeled container (e.g., Whirlpak™ sample bags), and submitted under chain of custody documentation to a Massachusetts-certified laboratory for analysis of asbestos via USEPA Method 600/R-93/116. 3. The soils of the east central portion of the courtyard will be covered with clean 6-mil polyethylene sheeting, pending the results of the asbestos analyses. 4. If asbestos is detected in any section of the east central portion of the courtyard, steps 3, 4 and 5 will be repeated for the affected section until no asbestos is detected. 5. Once the excavation of asbestos-contaminated soils is complete, these soils will remain covered with 6-mil polyethylene sheeting until excavation of the remainder of the 0-3 foot interval soils is completed. For more details see the Remainder of PCB Soil Excavation step.
Petroleum Soil Excavation A	10E	1. Soils from the petroleum-contaminated area close to and including the FO-1 fuel oil bunker area. This area (called the initial excavation area) will be the future location of the FO-1 soil repository. The soils of this area are contaminated from approximately 2-5 feet below grade to a smear zone straddling the water table. For this area, the visibly petroleum-contaminated soils from this area will be separated from those that are not visibly contaminated with petroleum. 2. The soils with no visible petroleum contamination will be stored in the non-asbestos soil storage area, located in the east central portion of the courtyard, pending on-Site re-use of the soils as backfill, more than three feet below final grade. 3. Disposal criteria data exists for the *in situ* petroleum contaminated soils of this area. If permitted by the receiving facility, the visibly petroleum-contaminated soils will be live loaded for off-site disposition. 4. Otherwise, these soils will be stockpiled separately from those scheduled for on-site re-use as backfill, within the east central portion of the courtyard. Discrete samples will be collected from the stockpiled petroleum-contaminated soils and composited for disposal criteria testing, following the procedures required by the receiving facility. These soils will remain in this location until a receiving facility provides approval of receipt. 5. If the petroleum contamination is present at and below the water table, if feasible, dewatering of the excavation will be conducted so that additional petroleum-contaminated soils can be excavated. Oily water removed from the excavation will be placed in frac tanks. The recovered oily water will be disposal criteria tested and shipped under appropriate documentation to a receiving facility. 6. Once the petroleum-contaminated soils are excavated to the extent feasible, soil samples will be collected from the bottom and sidewalls of the excavation for analysis of EPH and target PAHs via MassDEP's method and for TPH via USEPA Method 8100M. This analytical data

		will be used to evaluate the residual levels of petroleum contamination and whether free-phase petroleum remains following the completion of excavation.
Petroleum Soil Excavation B	10F	1. The soils of the petroleum-contaminated area located south and east of the initial excavation area (FO-1 fuel oil bunker area) will be excavated. This area (called the second excavation area) mostly has petroleum contamination in a smear zone straddling the water table, but in locations closer to the FO-1 fuel oil vault, may be as shallow as 10 feet below current grade. For this area, the overlying soils that are not visibly petroleum-contaminated will be excavated and placed in one of the following locations: (1) the non-asbestos soil storage area, located in the east central portion of the courtyard; or (2) temporarily in the excavated hole of the initial excavation area on polyethylene sheeting until they can be re-excavated. These soils will be re-used as on-Site backfill, more than three feet below final grade. Therefore, if petroleum-contaminated soils are excavated to the extent feasible, elsewhere in the second excavation area, soils that do not contain visible contamination can be directly placed in the area where excavation is completed, at depths more than 3 feet below final grade. 2. Disposal criteria data exists for the *in situ* petroleum contaminated soils, mostly from the shallow areas nearer the FO-1 fuel oil bunker. If permitted by the receiving facility, the visibly petroleum-contaminated soils will be live loaded for off-site disposition. 3. Otherwise, these soils will be stockpiled separately from those scheduled for on-site re-use as backfill, within the east central portion of the courtyard. Discrete samples will be collected from the stockpiled petroleum-contaminated soils and composited for disposal criteria testing, following the procedures required by the receiving facility. These soils will remain in this location until a receiving facility provides approval of receipt. 4. If the petroleum contamination is present at and below the water table, if feasible, dewatering of the excavation will be conducted so that additional petroleum-contaminated soils can be excavated. Oily water removed from the excavation will be placed in frac tanks. The recovered oily water will be disposal criteria tested and shipped under appropriate documentation to a receiving facility. 5. Once the petroleum-contaminated soils are excavated to the extent feasible, soil samples will be collected from the bottom and sidewalls of the excavation for analysis of EPH and target PAHs via MassDEP's method and for TPH via USEPA Method 8100M. This analytical data will be used to evaluate the residual levels of petroleum contamination and whether free-phase petroleum remains following the completion of excavation.
FO-1 Soil Repository	10G	1. Following completion of excavation of the petroleum soils near the retaining wall, the Gunite spray-on application will be applied to the retaining wall, or a concrete/bentonite slurry wall will be installed along portions of the base of the retaining wall; and (optional) a landtile PVC pipes and catch basin (water interceptor trench) will be installed in accordance with the specifications provided in Appendix H of the IRA Plan Modification and IRA Plans, submitted on November 2, 2016, to alleviate hydrostatic pressure that might increase from water buildup following sealing of the exterior of the retaining wall. However, the elevation of the water interceptor, if installed, will be

		determined in the field based on observations on the depth to water. 2. Either 6-inch or 8-inch oil recovery wells may be installed along the retaining wall in the excavation hole prior to backfilling, or they will be installed using a drill rig after backfilling the excavation. Another recovery well may also be located near the former GEC-1, where light NAPL was observed in August 2015. No recovery pump will be installed until such time as light NAPL is measured in one or more recovery wells and testing (such as light NAPL transmissivity testing) demonstrates that the light NAPL is recoverable. 3. Backfilling of the petroleum contaminated area outside the planned FO-1 soil repository will be completed using the stockpiled soils in the non-asbestos soil storage area that do not have visible petroleum contamination and well as any soils that may have been temporarily stored in the FO-1 soil repository. If needed, additional clean soils will be brought into the courtyard to complete the backfilling. 4. The FO-1 soil repository will be created. It is estimated to have dimensions of approximately 60 feet long by 40 feet deep and may have a depth as deep as two feet above the depth of the observed smear zone. The top of the FO-1 soil repository will be located three feet below final grade. The sides of the excavation will be lined with orange snow fencing. Inside the fencing, geotextile fabric will be installed along the sidewalls and bottom of the repository. If building wall or vault wall is present, it may also serve as part of the repository. 5. The dimensions of the FO-1 soil repository can be modified based on field decisions; however, if possible, it should be designed to hold a minimum of 1,000 cubic yards. The FO-1 soil repository must not extend to the locations of the planned storm water drainage system (depicted in plans in Appendix G), the slurry wall, water interceptor trench (optional) or the oil recovery wells.
Asbestos Soil Excavation C**	10H	1. Once the FO-1 soil repository is ready, soils from the stockpile located at the west end of the courtyard will be placed into the FO-1 soil repository. 2. Soils will be removed from the top three feet of each dry well and placed in the FO-1 soil repository. 3. Soils at the west end of the courtyard will be excavated an additional two feet and placed in the FO-1 soil repository. 4. Brick at the top of each dry well will be removed to lower each dry well to three feet below final grade. The top of each dry well will be sealed with concrete. 6. The Massachusetts-licensed asbestos manager will divide the west end of the courtyard into sections, and will collect five 0-1 inch soil samples from each section. For each section, these soil samples will be composited into a single sample, placed into a labeled container (e.g., Whirlpak™ sample bags), and submitted under chain of custody documentation to a Massachusetts-certified laboratory for analysis of asbestos via USEPA Method 600/R-93/116. 7. The soils of the west end of the courtyard will be covered with clean 6-mil polyethylene sheeting, pending the results of the asbestos analyses. 8. If asbestos is detected in any section of the west end of the courtyard, steps 3 (at one-foot intervals), 6 and 7 will be repeated for the affected section until no asbestos is detected 9. Once the excavation of asbestos-contaminated soils is complete, these soils will remain covered with 6-mil polyethylene sheeting until the

		protective barrier is installed.

Asbestos Soil Excavation D**	10I	1. Soils will be removed from the top three feet of the coal chute and placed in the FO-1 soil repository, so that the walls of the coal chute can be lowered to three feet below final grade. The top of the coal chute soil repository will be sealed with concrete. 2. Soils at the west central portion of the courtyard will be excavated one foot and placed in the FO -1 soil repository. 3. The Massachusetts-licensed asbestos manager will divide the west central portion of the courtyard into sections, and will collect five 0-1 inch soil samples from each section. For each section, these soil samples will be composited into a single sample, placed into a labeled container (e.g., Whirlpak™ sample bags), and submitted under chain of custody documentation to a Massachusetts-certified laboratory for analysis of asbestos via USEPA Method 600/R-93/116. 4. The soils of the west central portion of the courtyard will be covered with clean 6-mil polyethylene sheeting, pending the results of the asbestos analyses. 5. If asbestos is detected in any section of the west central portion of the courtyard, steps 2, 3 and 4 will be repeated for the affected section until no asbestos is detected. 6. Once the excavation of asbestos-contaminated soils is complete, these soils will remain covered with 6-mil polyethylene sheeting until excavation of the remainder of the 0-3 foot interval soils is completed. For more details see the Remainder of PCB Soil Excavation step.
Remainder of PCB Soil Excavation	10J	1. The remainder of the soils (determined not to contain asbestos, but might contain elevated PCBs) from the east central and west central portions of the courtyard will be excavated until three feet below final grade. These excavated soils will be placed in the FO-1 soil repository, if space permits. 2. If space is not sufficient, the soils will be stockpiled atop the polyethylene sheeting at the west end of the courtyard and the soils will be disposal criteria tested in accordance with procedures required by the receiving facility. The soils will be shipped off-site to the receiving facility, upon the authorization of the receiving facility. 3. The FO-1 soil repository will be covered with a distinctively colored geotextile membrane, indicating that it is the location of a soil repository. Three inches of gravel will be placed over the geotextile membrane. 4. The locations and elevations of the utility vault, dry wells and coal chute will be surveyed. 5. A clean utility corridor will be installed along the south side of the courtyard, near the Picker building. This clean utility corridor will house the storm water drainage system. It will be lined with a distinctively colored geotextile membrane, indicating it is a clean utility corridor. The location and elevation of the clean utility corridor will be surveyed. Eventually, a marker will be installed in the courtyard indicating the location of the clean utility corridor.

Installation of Protective Cover ***	10K	1. A geotextile membrane (unique from those of the soil repositories and clean utility corridors) will be installed over the courtyard soils that will be located 3 feet below grade. 2. Three feet of clean fill will be placed over the geotextile membranes and cement covers covering the courtyard, including soil repositories. Together the clean fill, geotextile membranes and cement covers constitute a protective barrier. 3. No trees or bushes with root structures extending more than 2.5 feet below grade when mature can be planted in the soils of the protective barrier. Trees and bushes may be planted in containers that are not integral to the protective barrier. 4. Permanent markers must be placed in the courtyard so that the locations of the clean utility corridors can be found in case of an emergency utility repair.

Notes: Although four areas are described as Asbestos Soil Excavation Areas, they actually contain soils with significant levels of PCBs. This description is intended to differentiate those PCB-contaminated soils that contain asbestos from those that do not.

*Excavation of Asbestos Soil Excavation Area A will be conducted to the depth necessary to achieve no detectable asbestos for the 0-1 inch composite soil samples. This excavation is needed so that excavation of petroleum-contaminated soils can be conducted unhindered by asbestos requirements.

** Excavation of Soil Excavation Areas B, C and D will be conducted until soils are three feet below final grade. If asbestos is still detected in 0-1 inch composite soil samples after reaching 3 feet below final grade, no further excavation is likely to be conducted. These soils will remain below the three foot thick protective barrier and will be subject to restrictions in the Notice of AUL requiring that future construction or other soil disturbance work at depths more than 3 feet below grade be done under the oversight of a Massachusetts-licenses asbestos project manager (in addition to a Licensed Site Professional, which will already be required).

*** A cross-section of the protective cover (TSCA cap alternative) is provided as Appendix R.

GEC plans to resume excavation of asbestos- and PCB-contaminated soils immediately after the MassDEP Bureau of Air and Waste approves Axiom's Non-Traditional Asbestos Work Plan and USEPA Region I provides coordinated approval of the risk-based cleanup of PCBs under 40 CFR 761.77 or provides a permit for a risk-based cleanup of PCBs (whichever applies). MassDEP Bureau of Waste Site Cleanup has conditionally approved the IRA. The excavation of the no. 6 fuel oil bunkers (FO-1 and FO-2) will be conducted upon completion of the asbestos- and PCB-contaminated soils in the portion of the courtyard where the fuel oil bunkers are located. The water interceptor trench (if installed) and oil recovery wells will follow the completion of the excavation of petroleum-contaminated soils near the retaining wall and the application of the spry on Gunite to the retaining wall and/or the installation of a slurry wall. The FO-1 soil repository will be created following completion of the excavation of petroleum-contaminated soils within the eastern courtyard. It is anticipated that it will take approximately two months to complete this project. The test boring and monitoring well installation program described in the original IRA Plan will be conducted once the planned excavation of petroleum-contaminated soils and decommissioning of the no. 6 fuel oil bunkers are completed.

5.2 Remediation Waste, Wastewater and Additives

For RTN 3-33101, RTN 3-33474 and RTN 3-33853, the following remediation waste is anticipated:

(1) between 1,500 and 2,000 cubic yards of soils from the original 0-3 foot interval contaminated (and as deep as an additional 6 feet near the FO-1 fuel oil bunker) with PCBs at levels <50 mg/kg, and may contain asbestos in all or part of the soils; Of this soil volume, to date, approximately 50 cubic yards of soils containing >50 mg/kg PCBs were excavated and transported to Wayne Disposal Inc., of Belleville, Michigan; approximately 144 cubic yards of soils were excavated and placed in on-Site soil repositories, and an additional 300 to 400 cubic yards of soils were excavated and are stockpiled at the west end of the courtyard. Based on the foregoing, approximately 500 to 600 cubic yards have been excavated to date, leaving approximately 900 to 1,400 cubic yards of PCB-contaminated soils left to excavate. Between the fuel oil vault and FO-1 excavation area, there is at least 1,125 cubic yards of anticipated soil repository storage space on-Site. If the volume of PCB/asbestos-contaminated soils exceed the available storage capacity, the excess contaminated soils will be transported off-site under Uniform Hazardous Waste Manifests to a facility approved to accept soils containing asbestos and/or >10 to 50 mg/kg PCBs (likely Waste Management of Norridgewock, Maine).

(2) If PCB levels of soils samples near boring B-18 exceed 50 mg/kg, up to approximately 50 cubic yards of soils will be excavated and live-loaded for transport under a Uniform Hazardous Waste Manifest to a facility approved to accept soils containing asbestos and >50 mg/kg PCBs. Wayne Disposal Inc., of Belleville, Michigan, is a potential receiving facility.

(3) Brick and/or concrete from the dismantling of the tops of the dry wells and coal chute so that these soil repository areas can be lowered to 3 feet below final grade. The brick and/or concrete will be disposed as asbestos-contaminated waste.

(4) All other solid wastes (e.g., PPE, polyethylene sheeting, plywood and spent decontamination supplies) will be shipped to Waste Management of Norridgewock, Maine, as potential asbestos- and/or PCB-contaminated waste.

(5) The gravel from the temporary roadway will be re-used on-Site as fill placed more than three feet below final grade.

Other anticipated remediation waste for RTN 3-33101 is the petroleum-contaminated soils located, based on recent analytical data, mostly below the PCB- and asbestos-contaminated soils. The petroleum-contaminated soils within, surrounding and below the fuel oil vaults will be excavated and transported under the appropriate manifests likely to ENPRO Services of Maine, Inc., in South Portland, Maine for disposal, or to Waste Management of Norridgewock, Maine. GEC anticipates generating up to 2,000 cubic yards of petroleum-contaminated soil, which will be transported off-site. This is an increase of 1,000 cubic yards from the original IRA Plan.

Any generated decontamination waste water will be properly collected and disposed of in accordance with the provisions provided in Appendix P.

If the groundwater table is reached, oily water is likely to be pumped from the excavation so that additional petroleum-contaminated soils can be excavated. The oily water will be pumped and held in a frac tank, until the water can be disposal criteria tested and a receiving facility can be identified. The oily water will be shipped to an appropriate receiving facility, likely under a uniform hazardous waste manifest. An assumption is made that up to 2,000 gallons of oily water may be pumped from the excavation.

No remedial additives are planned for these IRAs.

5.3 Contingency Plan / Remedial Monitoring Plan

Because the 0-5 foot interval soil sample from B-18 contained 29 mg/kg PCBs, USEPA Region I is requiring additional investigation of this area before remedial excavation is conducted in this area. Soil samples will be collected from up to nine borings advanced at B-18 (designated B-18A); five feet north, south, east and west of B-18 (designated B-18-5N, B-18-5S, B-18-5E and B-18-5W); and ten feet north, south, east and west of B-18 (designated B-18-10N, B-18-10S, B-18-10E and B-18-10W). Each of these borings will be advanced as space permits (e.g., no foundation wall or retaining wall is in the way). For each boring, soil samples will be collected from the 0-2, 2-4 and 4-6 foot intervals and placed in individual 8-ounce amber glass jars with Teflon-lined screw caps. The samples will be cooled to 4 ^{o}C, and submitted to Con-Test under chain-of-custody documentation for analysis of PCBs via USEPA Method 8082 with Soxhlet extraction. The ten-foot radius samples will be held at the laboratory with extraction, pending the results of the five-foot radius samples. Depending on the results of the 5-foot radius samples, one or more ten-foot radius samples may be released for extraction and analysis. Method blanks, laboratory control samples (LCS), LCS duplicates and surrogates will be used during the analysis and reported in the laboratory report. MassDEP's Compendium of Analytical Methods states there are no hold times for extraction prior to analysis. The hold time from extraction to analysis is 40 days; however, given the nature of this project, analysis will be conducted in less than 40 days following extraction. The analytical data will be evaluated relative to MassDEP's WSC-07-350, MCP Representativeness Evaluations and Data Usability Assessments.

The PCB analytical data will be used to determine if any soil samples contain >50 mg/kg PCBs exist at the Site, or if the 95th percentile upper confidence limit on the mean is greater than 10 mg/kg PCBs. If any soil sample contains >50 mg/kg PCBs, soils in this area will be excavated and transported off-Site to a hazardous waste facility. If the 95th percentile upper confidence limit on the mean is greater than 10 mg/kg PCBs, these soils will be excavated and either placed in an on-Site soil repository or transported off-Site to a facility authorized to accept >10 but <50 mg/kg PCBs.

At the same time the B-18 boring program is conducted, extra soils from the 0-2 and 2-4 foot intervals of B-18A, B-18-5N, B-18-5S, B-18-5E and B-18-5W will be composited into a single sample and submitted for disposal criteria testing and asbestos testing, in case the soils need to be excavated and transported off-Site. If insufficient soils are available to create the composite sample, additional borings will be advanced in the immediate vicinity of B-18 to add to the composite soil sample. The soil sampling plan for B-18 is provided as Appendix S.

If soils contain >50 mg/kg PCBs, the disposal criteria and asbestos data will be used to submit to a receiving facility to seek permission to ship prior to excavating the >50 mg/kg PCB soils (likely Wayne Disposal Inc., of Belleville, Michigan, as described in Section 5.3). If soils contain >10 but <50 mg/kg PCBs, the disposal criteria and asbestos data will be used to submit to a receiving facility to seek permission to ship prior to excavating the >10 but <50 mg/kg PCB soils (likely Waste Management of Norridgewock, Maine, as described in Section 5.3).

If excavation of B-18 soils is conducted for off-Site transport or placement in an on-Site repository, confirmatory soil sampling will be conducted following one of the following procedures: (1) north, south, east and west sidewall and bottom sampling, if less than approximately 25 cubic yards of soils are excavated; or (2) a TSCA-gridded sampling plan. The confirmatory soil samples will be analyzed for PCBs via USEPA Method 8082 with Soxhlet extraction.

Excavation of asbestos-contaminated surface soils will be conducted in stages in the following order: east end of courtyard, east central portion of courtyard, west central portion of courtyard and west end of courtyard. The east end and east central portion of the courtyard will be excavated first, in order to create an asbestos-remediated area to allow for the excavation of the remainder of the PCB-contaminated soils and the excavation of the petroleum contaminated soils, without dealing with asbestos-contaminated material, asbestos decontamination and asbestos air monitoring (OHM decontamination and dust monitoring will still be followed). For each area in sequence, the top 1-foot of existing soils will be removed; then the area will be divided in sub-areas for the collection of collecting composited soil samples for asbestos analysis. Each composite will be comprised of five 0-1 inch samples collected from throughout a sub-area. The asbestos sampling will be conducted by Axiom asbestos project manager. If a sub-area is not clear of asbestos, another round of 1-foot excavation will be conducted in that sub-area, followed by another round of composite soil sampling. This procedure will be followed until all sub-areas have no detectable asbestos, before moving to the next stage of remediation.

Two types of air monitoring will be conducted: (1) dust monitoring during all soil excavation or movement activities, following the procedures provided in the Dust Monitoring Procedures (Appendix P), will be conducted by GEC personnel; and (2) asbestos air monitoring will be conducted during all soil excavation or movement activities, unless a particular area of the courtyard has been cleared of asbestos (Appendix P), by Axiom's asbestos project manager. Refer to Figure 10A for the asbestos air sampling locations. The dust monitoring locations will be set at two of the asbestos air sampling locations.

For PCB-contaminated or petroleum-contaminated soil volumes that will be transported off-Site, disposal criteria testing will be conducted in accordance with the requirements of the receiving facility, and will include asbestos analysis. During the September 2016 investigations, *in situ* sampling was conducted of the petroleum-contaminated soils and the samples were submitted for disposal criteria testing, including for asbestos. If sufficient for the receiving facility, the petroleum-contaminated soils will be excavated and live-loaded. Given the limited courtyard space, this is the preferred procedure.

During excavation of petroleum-contaminated soils, the sidewall and bottom soil samples from the excavation will be analyzed for EPH and PAHs via MassDEP's method and for total petroleum hydrocarbons via USEPA Method 8100M. This data will be used, in part, to determine the potential for free phase petroleum to still be present in the soils. Based on the available data and the characteristics of no. 6 fuel oil, VPH and target VOC analysis will not be conducted unless elevated PID readings are encountered during screening of the excavation or headspace screening of the soils.

As needed, any recovered oily water from the excavation, water pumped from the containment area along the exterior of the retaining wall, and decontamination water will be analyzed for disposal criteria, for use in obtaining approvals from receiving facilities.

Following completion of the excavation programs, test borings will be advanced and monitoring wells installed as described in the petroleum contaminated area, with the well screens spanning the entire smear zone of the petroleum contamination. Soil and groundwater samples will be collected for analysis of EPH and target PAHs via MassDEP's method and for total petroleum hydrocarbons via USEPA Method 8100M. Monitoring wells will be periodically gauged for depth to groundwater and product thickness. The soil and groundwater analytical data and monitoring well gauging data will be evaluated to determine if significant light NAPL may remain in the subsurface.

5.4 Federal, State or Local Permits

A modified Non-Traditional Asbestos Abatement Work Plan has been submitted by Axiom to MassDEP Bureau of Air and Waste and approved. This Work Plan and any conditions specified by MassDEP will be followed during implementation of the RAM Plan, conditionally approved IRA and coordinated approval of the Application for Risk-Based Cleanup of PCBs.

The MassDEP Bureau of Waste Site Cleanup issued a conditional approval, dated November 22, 2016, of the IRA Plan Modification and IRA Plans for RTN 3-33101, 3-33793 and 3-33853, dated November 2, 2016 and is provided as Appendix T. The conditions of the conditional approval will be followed during this RAM/IRA/Risk-Based Cleanup of PCBs.

The MassDEP Bureau of Waste Site Cleanup issued a conditional approval, dated December 7, 2016, of the RAM Plan for RTN 3-33474, submitted on December 1, 2016 and is provided as Appendix T. The conditions of the conditional approval will be followed during this RAM/IRA/Risk-Based Cleanup of PCBs.

USEPA Region I determined that the Site conditions are subject to the PCB regulations within TSCA, and is requiring the submittal of an Application for Risk-Based Cleanup of PCBs pursuant to 40 CFR 761.61(c), with a request for coordinated approval from USEPA Region I and MassDEP pursuant to 40 CFR 761.77. This document constitutes that Application. Any approval conditions and TSCA requirements will be followed.

The local Conservation Commission provided the developer with an Order of Conditions for the ongoing site work within the Picker building and courtyard. The required erosion controls, depicted on the drawings in Appendix Q, are already in place. The requirements of the Order of Conditions will be complied with as they pertain to the IRA activities. Permits were obtained from the local Fire Department to remove the two gasoline USTs. The tank removals were already conducted. Copies of the permits are provided in Appendix G of the IRA Plan Modification for RTN 3-33101, submitted on April 19, 2016. It is anticipated that no other federal or state permits will be required to conduct the RAM/IRA/Risk-Based Cleanup of PCBs.

5.5 Public Involvement Activities

Pursuant to 310 CMR 40.0477 and 40.1403(3)(d), the Mayor of Lowell and Health Director were provided written notification of the purpose, nature and expected duration of the RAM for RTN 3-33474, which was submitted on December 1, 2016. This RAM covers the same activities as described in this EPA Risk-Based Application. Copies of the notification letters are provided in Appendix U.

Prior to the onset of remedial activities, letters will be sent to the City of Lowell Chief Municipal Officer and Board of Health to provide notification of the proposed activities, project schedule and dust monitoring requirements. There are no residents or commercial tenants of either the Picker Building or Boiler House. Therefore, there are no persons to provide notification prior to starting the MCP/TSCA/Asbestos remedial activities.

6.0 DEED RESTRICTION / LONG-TERM MONITORING AND MAINTENANCE PLAN / FINANCIAL ASSURANCE

Following completion of the MassDEP approved IRA/RAM/Asbestos Cleanup and EPA Region I coordinated approval of the TSCA Risk-Based Cleanup of PCBs, a deed restriction (also called a Notice of AUL) will be recorded with the registry of deeds. The proposed notifications, permitted activities and uses, inconsistent activities and uses, and conditions and obligations of the Notice of AUL are provided in Appendix V.

Combined, the isolated soil repositories and protective barrier, comprised of clean fill over a marker layer, is an alternative to the TSCA cap. A Long-Term Monitoring and Maintenance Plan for the protective barrier and isolated soil repositories will be included in the completion report for the RAM/IRA/Risk-Based Cleanup of PCBs. Also included in the completion report will be a financial assurance certification required for maintenance of the protective barrier and isolated soil repositories, and also a Soil Management Plan for use when the emergency or non-emergency utility repair work is conducted in the clean utility corridors.

7.0 OWNER CERTIFICATION

Appendix W contains a written certification by the owner of the property where the cleanup is located (Massachusetts Mills III Limited Partnership). The certification states that the sampling plans, sample collection procedures, sample preparation procedures, extraction procedures, and instrumental/chemical analysis procedures used to assess or characterize the PCB contamination at the cleanup site, are on file at the location designated in the certificate, and are available for EPA inspection.

8.0 SITE ACCESS AGREEMENT

The PCB cleanup will be conducted by Joseph Mullins, General Partner/Owner of Massachusetts Mills III LP. The current owner of the property where PCB cleanup will be conducted is Massachusetts Mills III Limited Partnership, c/o Joseph Mullins, 31 Saint James

Avenue, Ste. 940, Boston, MA 02116. A site access agreement is not needed since the property owner is conducting the clean-up of PCBs.

9.0 WARRANTY

The conclusions and recommendations contained in this report are based on the information readily available to GEC and upon the current regulatory climate as of December 8, 2016. GEC provides no warranties on information provided by third parties and contained herein. Data compiled was in accordance with GEC's existing procedures and should not be construed beyond its limitations. Any interpretations or use of this report other than those expressed herein are not warranted.

The use, partial use, or duplication of this report without the express written consent of Goldman Environmental Consultants, Inc. and/or R-M Developer, LLC is strictly prohibited. This report is subject to GEC's Contract for Consulting Services with R-M Developer, LLC.

Respectfully Submitted,
Goldman Environmental Consultants, Inc.

Eileen A. Furlong	*Brian T. Butler*
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